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ABSTRACT

The main purpose of the handbook is to provide occupational information that broadens the knowledge of choices available to young people and helps them make intelligent career plans. It is also a useful resource for persons entering or reentering the work force at different stages of their lives. For hundreds of occupations the handbook answers such questions as: What does a person actually do on the job? What abilities and interests does the job call for? What are the working conditions like? What will be the job opportunities in coming years? This edition of the handbook presents occupational materials in new clustering system designed to organize occupations by related activities. The new Handbook also includes expanded earnings information, additional information on job characteristics as they relate to young people's interests and abilities, and finally an extensively revised guide on how to use the handbook for career guidance. (Author)

Pointers on Using the Handbook

To learn the contents and arrangement of this Handbook, see How the *Handbook* is Organized, page 3.

To locate an occupation or industry in this book, see:
Table of Contents, page IX.
Alphabetical Index, page 803.
Dictionary of Occupational Titles Index, page 826.

For a general view of work and jobs in the United States, read the chapter on Tomorrow's Jobs, page 15.

Forecasts of the future are precarious! To interpret the standards on the outlook in each occupation, keep in mind the points made on page 15, as well as the method presented in the Technical Appendix, page 15.

The job picture is constantly changing. To find out how you can keep your information up to date, see the section on Sources of Additional Information, page 10.

You may need local information, too. The *Handbook* gives facts about each occupation for the United States as a whole. For suggestions on sources of additional information for your own locality, see page 12.

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Occupational Outlook Handbook

1974-75 Edition

U.S. DEPARTMENT OF LABOR
Peter J. Brennan, Secretary
BUREAU OF LABOR STATISTICS
Julius Shiskin, Commissioner

1974

Bulletin 1785

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Foreword

Today, young Americans must be aware of the effect sweeping changes in our society will have on their career futures. The 1974-75 edition of the *Occupational Outlook Handbook* is a key tool for helping young people make sensible career decisions.

Because changing demands cause shifts in skill and training requirements for occupations, students should begin the process of career exploration early in their lives. By acquiring a broad knowledge of occupations, each student can become aware of many career alternatives and be prepared to make suitable choices that coincide with his or her abilities and aspirations.

The main purpose of the *Handbook* is to provide occupational information that broadens the knowledge of choices available to young people and helps them make intelligent career plans. It is also a useful resource for persons entering or reentering the work force at different stages of their lives.

For hundreds of occupations, the *Handbook* answers such questions as: what does a person actually do on the job; what abilities and interests does the job call for; what kind of schooling and other training is required for the job; what are the working conditions like; and most importantly, what will be the job opportunities in coming years?

For more than a quarter of a century, the *Handbook* has been the standard reference for vocational guidance information. Our hope in the Department of Labor is that this publication will continue to be a valuable tool in guiding future workers into jobs which will be both satisfying and productive.

PETER J. BRENNAN, *Secretary of Labor*

Prefatory Note

Between 1972 and 1985 employment in the United States will likely increase by as much as 20 million jobs. Accompanying this increase, a significant shift from goods-producing industries—agriculture, mining, construction, and manufacturing—toward service-producing industries—transportation and utilities, trade, finance, services, and government—is expected. This expected shift is especially significant for educational and vocational planning. To assure that young people will have the necessary skills to meet future job requirements will require flexibility in our educational system and necessitate a continuing appraisal of career opportunities in the years ahead.

With respect to the latter, for the past 3 decades, the Bureau of Labor Statistics has been researching occupational and manpower trends. The major publication of this research is the *Occupational Outlook Handbook*, which provides encyclopedic information on work for over 800 occupations and 30 major industries. The *Handbook* information is based on BLS analysis of data received from business firms, trade associations, labor unions, professional societies, educational institutions, government agencies, and other groups. In addition to the *Handbook*, which is published every other year, other BLS vocational guidance materials include reprints of *Handbook* statements on individual occupations and the Occupational Outlook Quarterly, issued to supplement the *Handbook* with articles on current developments in the occupational outlook field.

With the current need to strengthen programs of career education, I feel that the *Occupational Outlook Handbook* will be more useful for students, counselors, and educators than ever before. To that end, the Bureau has done considerable revision work. This edition presents occupational materials in a new clustering system designed to organize occupations by related activities. The new *Handbook* also includes expanded earnings information, additional information on job characteristics as they relate to young people's interests and abilities, and finally an extensively revised guide on how to use the *Handbook* for career guidance.

JULIUS SHISKIN, *Commissioner, Bureau of Labor Statistics*

Letter of Endorsement

Work can be one of life's most rewarding experiences. A job can offer pride in achievement and an opportunity for individual growth, as well as the security of an adequate income. But satisfying employment seldom is achieved without informed career planning.

Up-to-date and accurate occupational information is a keystone to career planning. The wealth of information contained in this edition of the *Occupational Outlook Handbook* provides a major resource. For more than 800 occupations and 30 major industries, timely, accurate, and useful materials are provided. Counselors and counselees can find a ready source of comprehensive information in the *Handbook* covering what workers do in various occupations, training and educational requirements, advancement possibilities, occupational outlook, earnings and working conditions, and sources of additional information.

The new edition of the *Occupational Outlook Handbook* will continue to be an invaluable tool for counselors in various work settings who are responsible for helping clients make sound educational and vocational choices and plans that will lead to rewarding occupational endeavors in the Nation's job market.

Dr. S. Norman Feingold, President
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Contributors

The *Handbook* was prepared in the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook, under the supervision of Russell B. Flanders. General direction was provided by Dudley E. Young, Assistant Commissioner for Manpower Structure and Trends.

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Government Sources

Federal. Department of Agriculture; Atomic Energy Commission; Department of Commerce—National Oceanic and Atmospheric Administration; General Accounting Office; General Services Administration—National Archives; Government Printing Office; Department of Health, Education, and Welfare—Food and Drug Administration, and National Institutes of Health; Department of Interior; Department of Justice—Federal Bureau of Investigation; National Aeronautics and Space Administration; Department of the Navy—Naval Oceanographic Office; Department of Transportation—Federal Aviation Administration; Treasury Department—Internal Revenue Service; U.S. Postal Service; and Veterans Administration.

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Private Sources

Membership Groups. American Association of Colleges of Pharmacy; American Bankers Association; American Dietetic Association; American Home Economic Association; American Petroleum Institute; American Podiatry Association; American Society of Civil Engineers; B'nai Brith; British Information Services; Instrument Society of America; International Alliance of Theatrical Stage Employers and Moving Picture Machine Operators of the United States and Canada; International Association of Machinists and Aerospace Workers; International Ladies' Garment Workers' Union; Iron and Steel Institute; Lutheran Council in United States of America; Marble Institute of America; Motor Vehicle Manufacturers Association; Tile Contractors Association of America, Inc.; and Washington D.C. Board of Realtors, Inc.

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Publications. *Bar Server Handbook; Minneapolis Tribune; Motel/Hotel Inn Journal; Signs of the Times* magazine; *Washington Post;* and *Washington Star-News.*

Schools. California Technical Institute; George Washington University; Georgetown University; Montgomery Junior College; Stanislaus State College; and University of Maryland.

Others. Children's Memorial Hospital of Chicago; Kennedy Center; National Ballet; Don Ross, United Nations Information Center; Washington (D.C.) Hospital Center; and Washington (D.C.) Metropolitan Area Transit Authority.

Note

A great many trade associations, professional societies, unions, and industrial organizations are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of *Handbook* users, the statements on separate occupations or industries list some of the organizations or other sources which may be able to provide further information. Although these references were assembled with care, the Bureau of Labor Statistics has no authority or facilities for investigating organizations. Also, since the Bureau has no way of knowing in advance what information or publications each organization may send in answer to a request, the Bureau cannot evaluate the accuracy of such information. *The listing of an organization, therefore, does not in any way constitute an endorsement or recommendation by the Bureau or the U.S. Department of Labor, either of the organization and its activities or of the information it may supply.* Such information as each organization may issue is, of course, sent out on its own responsibility.

The occupational statements in this Handbook are not intended, and should not be used, as standards for the determination of wages, hours, jurisdictional matters, appropriate bargaining units, or formal job evaluation systems. These descriptive statements are presented in a general, composite form and, therefore, cannot be expected to apply exactly to specific jobs in a particular industry, establishment, or locality.

Contents

Guide to the Handbook	Page
HOW THE HANDBOOK IS ORGANIZED	3
TOMORROW'S JOBS	15
The Outlook for Occupations	
INDUSTRIAL PRODUCTION AND RELATED OCCUPATIONS	25
Foundry occupations	26
Patternmakers	26
Molders	26
Coremakers	29
Machining occupations	31
All-round machinists	31
Instrument makers (mechanical)	33
Machine tool operators	35
Set-up men (machine tools)	37
Tool and die makers	38
Printing occupations	40
Bookbinders and related workers	40
Composing room occupations	41
Electrotypers and stereotypers	43
Lithographic occupations	45
Photoengravers	46
Printing pressmen and assistants	48
Other industrial production and related occupations	50
Assemblers	50
Automobile painters	51
Automobile trimmers and installation men (automobile upholsterers)	53
Blacksmiths	55
Boilermaking occupations	56
Electroplaters	58
Foremen	60
Forge shop occupations	61
Furniture upholsterers	64
Inspectors (manufacturing)	66
Millwrights	67
Motion picture projectionists	69
Photographic laboratory occupations	70
Power truck operators	73
Production painters	74
Stationary engineers	75
Stationary firemen (boiler)	77
Waste water treatment plant operators	79
Welders and flame cutters	81
OFFICE OCCUPATIONS	85
Clerical occupations	86
Bookkeeping workers	87
Cashiers	88
File clerks	90
Hotel front office clerks	91
Office machine operators	92
Postal clerks	94
Receptionists	96
Shipping and receiving clerks	97
Statistical clerks	99
Stock clerks	101
Stenographers and secretaries	102
Typists	105
Computer and related occupations	107
Electronic computer operating personnel	107
Programmers	109
Systems analysts	111
Banking occupations	114
Bank clerks	114
Bank officers	116
Bank tellers	117
Insurance occupations	119
Actuaries	119
Claim adjusters	121
Claim examiners	123
Underwriters	125
Administrative and related occupations	128
Accountants	128
Advertising workers	130
City managers	132
College student personnel workers	134
Credit officials	137
Hotel managers and assistants	139
Industrial traffic managers	140
Lawyers	141
Marketing research workers	144

Personnel workers 146
Public relations workers 147
Purchasing agents 150

SERVICE OCCUPATIONS 153
Cleaning and related occupations 155
Building custodians 155
Exterminators 156
Hotel housekeepers and assistants . 159
Food service occupations 161
Bartenders 161
Cooks and chefs 163
Meatcutters 165
Waiters and waitresses 166
Personal service occupations 169
Barbers 169
Bellmen and bell captains 170
Cosmetologists 171
Funeral directors and embalmers .. 173
Private household service occupations .. 176
Private household workers 176
Protective and related service occupations 179
FBI special agents 179
Firefighters 181
Guards and watchmen 183
Police officers 185
State police officers 187
Health and regulatory inspectors (Government) 189
Construction inspectors (Government) 195
Other service occupations 199
Mail carriers 199
Telephone operators 200

EDUCATION AND RELATED OCCUPATIONS 203
Teaching occupations 204
Kindergarten and elementary school teachers 204
Secondary school teachers 206
College and university teachers .. 208
Library occupations 212
Librarians 212
Library technical assistants 215

SALES OCCUPATIONS 218
Automobile parts countermen 219
Automobile salesworkers 220
Automobile service advisors 222
Gasoline service station attendants 224
Insurance agents and brokers 226
Models 228
Manufacturers salesworkers 230
Real estate salesworkers and brokers 232
Retail trade salesworkers 235
Routemen 237
Securities salesworkers 239
Wholesale trade salesworkers 241

CONSTRUCTION OCCUPATIONS 245
Asbestos and insulation workers .. 248
Bricklayers 250
Carpenters 252
Cement masons (cement and concrete finishers) 254
Construction laborers 256
Electricians (construction) 258
Elevator constructors 260
Floor covering installers 261
Glaziers 264
Lathers 265
Marble setters, tile setters, and terrazzo workers 266
Operating engineers (construction machinery operators 269
Painters and paperhangers 271
Plasterers 273
Plumbers and pipefitters 275
Roofers 277
Sheet-metal workers 279
Stone masons 280
Structural, ornamental, and reinforcing iron workers, riggers, and machine movers 282

OCCUPATIONS IN TRANSPORTATION ACTIVITIES 285
Air transportation occupations 286
Air traffic controllers 286
Aircraft mechanics 287
Airline dispatchers 289
Flight attendants 290
Flight engineers 292
Ground radio operators and teletypists 293
Pilots and copilots 294
Traffic agents and clerks 297
Merchant marine occupations 298
Merchant marine officers 298
Merchant seamen 301
Railroad occupations 305
Brakemen 305
Bridge and building workers 306
Clerks 307
Conductors 307

Locomotive engineers 308
Locomotive firemen 309
Shop trades 310
Signal department workers 311
Station agents 312
Telegraphers, telephoners, and towermen 312
Track workers 313
Driving occupations 315
Intercity bus drivers 315
Local transit busdrivers 317
Local truck drivers 319
Long distance truck drivers 321
Parking attendants 324
Taxi drivers 325

SCIENTIFIC AND TECHNICAL OCCUPATIONS 329
Conservation occupations 332
Foresters 332
Forestry aides and technicians 334
Range managers 335
Soil conservationists 337
Engineers 339
Aerospace 342
Agricultural 343
Biomedical 343
Ceramic 344
Chemical 345
Civil 345
Electrical 346
Industrial 347
Mechanical 348
Metallurgical 349
Mining 350
Environmental scientists 352
Geologists 352
Geophysicists 354
Meteorologists 357
Oceanographers 359
Life science occupations 363
Biochemists 363
Life scientists 365
Soil scientists 369
Mathematics occupations 371
Mathematicians 371
Statisticians 374
Physical scientists 377
Astronomers 377
Chemists 379
Food scientists 381
Physicists 383
Technician occupations 387
Broadcast technicians 387
Draftsmen 389
Engineering and science technicians 391
Food processing technicians 396
Surveyors 399

MECHANICS AND REPAIRMEN 403
Telephone craft occupations 405
Central office craft occupations ... 405
Central office equipment installers . 406
Linemen and cable splicers 407
Telephone servicemen 409
Other mechanics and repairmen 411
Air-conditioning, refrigeration, and heating mechanics 411
Appliance servicemen 413
Automobile body repairmen 415
Automobile mechanics 417
Boat motor mechanics 420
Bowling pin-machine mechanics .. 422
Business machine servicemen 423
Computer service technicians 426
Diesel mechanics 428
Dispensing opticians and optical mechanics 431
Electric sign servicemen 433
Farm equipment mechanics 435
Industrial machinery repairmen ... 437
Instrument repairmen 438
Jewelers 440
Locksmiths 442
Maintenance electricians 444
Motorcycle mechanics 446
Piano and organ servicemen 448
Shoe repairmen 451
Television and radio service technicians 452
Truck mechanics and bus mechanics . 454
Vending machine mechanics 457
Watch repairmen 459

HEALTH OCCUPATIONS 463
Dental occupations 465
Dentists 465
Dental assistants 467
Dental hygienists 469
Dental laboratory technicians 471
Medical practitioners 473
Chiropractors 473
Optometrists 475
Osteopathic physicians 476
Physicians 478

Podiatrists 481
Veterinarians 483
Medical technician, technologist, and assistant occupations 485
Electrocardiograph technicians ... 485
Electroencephalographic technicians 486
Medical assistants 488
Medical laboratory workers 489
Medical record technicians and clerks 492
Operating room technicians 494
Optometric assistants 496
Radiologic (X-ray) technicians 497
Respiratory therapists 499
Nursing occupations 501
Registered nurses 501
Licensed practical nurses 504
Nursing aides, orderlies, and attendants 505
Therapy and rehabilitation occupations 508
Occupational therapists 508
Occupational therapy assistants ... 510
Physical therapists 511
Physical therapist assistants and aides 512
Speech pathologists and audiologists 514
Other health occupations 517
Dietitians 517
Hospital administrators 519
Medical record administrators 521
Pharmacists 523
Sanitarians 525

SOCIAL SCIENTISTS 529
Anthropologists 529
Economists 532
Geographers 535
Historians 534
Political scientists 538
Sociologists 539

SOCIAL SERVICE OCCUPATIONS 543
Counseling occupations 544
School counselors 544
Employment counselors 546
Rehabilitation counselors 548
College career planning and placement counselors 550
Clergymen 553
Protestant ministers 553
Rabbis 555
Roman Catholic priests 556
Other social service occupations 559
Cooperative extension service workers 559
Home economists 560
Psychologists 563
Recreation workers 566
Social service aides 568
Social workers 570

ART, DESIGN, AND COMMUNICATIONS-RELATED OCCUPATIONS 575
Performing artists 576
Actors and actresses 576
Dancers 578
Musicians 581
Singers 583
Design occupations 586
Architects 586
Commercial artists 589
Displaymen 591
Floral designers 593
Industrial designers 595
Interior designers 597
Landscape architects 599
Photographers 602
Urban planners 604
Communications-related occupations .. 606
Interpreters 606
Newspaper reporters 609
Radio and television announcers .. 611
Technical writers 613

The Outlook for Industries

AGRICULTURE 619

MINING AND PETROLEUM INDUSTRY 629
Coal mining 630
Petroleum and natural gas production and processing 634

CONSTRUCTION 639

MANUFACTURING 641
Aircraft, missile, and spacecraft 643
Aluminum 649
Apparel 654
Atomic energy field 660
Baking 669
Drug 674
Electronics 679
Foundries 684

Industrial chemical 713
Iron and steel 692
Logging and lumber mills 700
Motor vehicle and equipment 704
Office machine and computer 711
Paper and allied products 716
Petroleum refining 722
Printing and publishing 725

TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES 729
Civil aviation 731
Electric power 734
Merchant marine 743
Radio and TV broadcasting 747
Railroads 752
Telephone 755
Trucking 758

WHOLESALE AND RETAIL TRADE ... 763
Restaurants 764
Retail food stores 767

FINANCE, INSURANCE, AND REAL ESTATE 771
Banking 772
Insurance 775

SERVICE AND MISCELLANEOUS INDUSTRIES 779
Hotels 781
Laundry and dry cleaning 784

GOVERNMENT 787
Federal civilian employment 789
Postal service 793
State and local government 797
Armed Forces 799

TECHNICAL APPENDIX 801

ALPHABETICAL INDEX TO OCCUPATIONS AND INDUSTRIES ... 803

DICTIONARY OF OCCUPATIONAL TITLES (D.O.T.) INDEX 826

GUIDE TO THE HANDBOOK

HOW THE HANDBOOK IS ORGANIZED

The *Handbook* begins with two introductory chapters designed to help counselors and students make effective use of the book and to give them a general view of the world of work.

This chapter describes the contents and organization of the book. It tells how the information was assembled, and discusses a number of points that need to be kept in mind in interpreting the statements. It also gives suggestions regarding supplementary sources of occupational information, and tells how readers can keep up to date on developments affecting the employment outlook in different occupations. The second introductory chapter describes some of the most important occupational and industrial employment trends, to provide a background for interpreting the reports on individual occupations.

Occupation and Industry Reports

The reports on different fields of work that make up the main body of the *Handbook* are grouped into two major divisions: Employment Outlook for Occupations and Employment Outlook for Industries. Within the occupational division there are 13 career cluster groups—Industrial Production and Related Occupations; Office Occupations; Service Occupations; Education and Related Occupations; Sales Occupations; Construction Occupations; Occupations in Transportation Activities; Scientific and Technical Occupations; Mechanics and Repairmen; Health Occupations; Social Science Occupations; Social Service Occupations; and Art, Design, and Communications occupations. These career clusters help relate the outlook materials to school curriculum and occupational training programs, career ladders and lattices, and fields of interest for young persons engaged in career exploration and planning. The clusters are based on a concept of related activities. Physicians, for example, are included in the same section of the *Handbook* as hospital attendants and all other health employees. Within each of these career clusters, occupations are further grouped into related sub-fields. Within the office-occupations cluster, the reader can find groups for clerical occupations, computer and related occupations, banking occupations, insurance occupations, and administrative and related occupations. The industry reports are grouped according to major industry divisions in the economy—agriculture; mining; construction; manufacturing; transportation; communications and public utilities; wholesale and retail trade; finance, insurance, and real estate; service and miscellaneous; and Government. An introductory statement for each major industry division provides information on occupational trends in the industry.

Indexes and Appendix

To help the readers locate information on the occupations in which they are interested, a detailed list of the occupational reports, by field of work, is provided in the table of contents at the front of the book. An alphabetical index is also provided at the back of the book. The occupations covered in the *Occupational Outlook Handbook* also are coded according to the occupational classification system developed by the U.S. Department of Labor and published in the *Dictionary of Occupational Titles*. This *Dictionary* provides a code number (D.O.T. number) for each occupation included in it; the code number can be used as a filing system for occupational information. The code numbers of the D.O.T. are listed in parentheses immediately below the main occupational group headings in the *Handbook*. An index listing occupations covered in the *Handbook* by D.O.T. number is also provided at the back of the book. Volumes I and II of the D.O.T. may be sought for further information; they also contain job classifications and definitions. A D.O.T. supplement lists individual physical demands, working conditions, and training-time data for each job defined in the *Dictionary*.

The technical appendix of this *Handbook* discusses the sources and methods used to analyze the occupational outlook in different fields of work. It is designed for readers wishing more information on this subject than is included in this chapter.

Sources of Information

Information, both on employment trends and outlook and on the many related topics discussed in the occupational reports, was drawn from a great variety of sources. Interviews with hundreds of experts

in industry, unions, trade associations, and public agencies provided a great deal of up-to-date information. The Bureau's other research programs were a second source: they supplied data on employment in different industries, productivity and technological developments, wages and working conditions, trade union agreements, industrial hazards, and a number of other topics. Additional data regarding the nature of the work in various occupations, training and licensing requirements, wages, and employment trends were provided by other agencies of the Federal Government—among them, the Bureau of Apprenticeship and Training and the U.S. Employment Service, Manpower Administration, Department of Labor; the Bureau of the Census, Department of Commerce; the Office of Education and the Vocational Rehabilitation Administration, Department of Health, Education, and Welfare; the Veterans Administration; the Civil Service Commission; the Interstate Commerce Commission; the Civil Aeronautics Board; the Federal Communications Commission; the Department of Transportation; and the National Science Foundation. Many other public and private organizations—educational institutions, business firms, professional societies, trade associations, and trade unions—also made available published data and supplied much helpful information through interviews.

Occupations Covered

The more than 850 occupations discussed in the 325 separate sections of the *Handbook* generally are those of greatest interest to young people. Most major occupations requiring long periods of education or training are discussed, as are a number of small but rapidly growing fields and other occupations of special interest. In total, the occupations covered account for about 97 percent of all workers in sales occupations; about 95 percent of all workers in professional and related occupations; about two-thirds of all workers in skilled, clerical, and service occupations, and two-fifths of those in operative occupations. Smaller proportions of managerial workers and laborers are discussed. The main types of farming occupations also are discussed.

After the information from these many sources was compiled and analyzed in conjunction with the Bureau's overall economic model, conclusions were reached as to prospective employment trends in the various occupations. (See the Technical Appendix for a discussion of the methodology used in employment outlook analysis.) In addition, estimates were made of the numbers of job openings that will be created by retirements and deaths and transfers out of each occupation. The supply of new workers likely to be available in a particular field also was analyzed, by studying statistics on high school and college enrollments and graduations, as well as data on the numbers of apprentices in skilled trades, re-entries into an occupation, and transfers into an occupation.

Preliminary drafts of the occupational reports were reviewed by officials of leading companies, trade associations, trade unions, and professional societies, and by other experts. The information and conclusions presented in each report thus reflect the knowledge and judgment not only of the Bureau of Labor Statistics staff, but also of leaders in the field discussed, although the Bureau, of course, takes full responsibility for all statements made.

Points to Bear in Mind in Using the Handbook

The information contained in the individual sections of each occupational statement follows a standard format under the headings: nature of work; places of employment; training, other qualifications and advancement; employment outlook; earnings and working conditions, and sources of additional information. In using the *Handbook* it is important to keep in mind the purposes for which the information was designed. Also, because of imperfect data sources, the limited length of each occupational statement, and many other factors, each of the sections has its own unique limitations. The following describes the information in each of the sections, including its purpose and its limitations.

The Nature of the Work section of each *Handbook* statement describes the major job duties performed by a worker in the occupation. It is intended to show young people what the worker does and how he does it.

Each job description is typical. However, job duties may vary by factors such as employer and size of the employing organization, geographic location of the job, and other variables.

In some occupations, individual workers specialize in certain tasks. In others they perform the entire range of work in the occupation. This can be illustrated by the field of medicine, where doctors usually specialize because of the amount of skill and knowledge required to function in each area.

Occupational skill requirements continually change along with changes in technology, industrial processes, and products. Analysts who prepare the *Handbook* attempt to include information on the latest changes but because of the rapidity of technological improvement and

innovation in some fields of work all developments are not covered in the *Handbook*.

The nature of the work section of each occupational statement is most valuable when used with other information in the statement. The descriptions of the nature of the work may lead one to other information that is important to job satisfaction. For example, the descriptions of some construction jobs indicate that the work is done outdoors. Information on other jobs indicates that the worker sits indoors at a desk most of the time. Many of these job characteristics are described further in the sections on working conditions.

The Places of Employment section provides information on the number of workers in an occupation and, when data are available, on the proportions of women and part-time workers. Industries that are major employers are discussed and the geographic concentration of employment is noted. When employment in a specific industry or area of the country does not significantly vary from the overall employment distribution, such information generally is not presented in the statement.

The places of employment section is designed to provide readers with information on the quantitative importance of the occupation in the economy, as well as to alert readers to potential incompatibilities between their career preferences and the occupation. For example, the data in the places of employment section can indicate that because of the geographic distribution of employment it may be difficult to live near family and friends or in a particular climate and at the same time have good employment prospects. However, data in the *Handbook* indicate that employment in most occupations is widespread enough that career choices usually need not be changed because of geographical considerations.

This section also highlights other factors affecting occupational choice that are generally explained in more detail in other sections of the statement. For example, when the employment size of two occupations is significantly different, the larger occupation usually will have more job openings each year because of the large number of workers who die or retire each year. The need to fill job openings that result from persons leaving the labor force accounts for more than half of all openings. In addition, occupations employing a high proportion of women generally have relatively higher numbers of annual job openings than occupations employing predominantly men because many women leave the workforce to have children and raise families.

The greater the diversity in the places of employment in an occupation, the more likely it is that less comprehensive data will be presented in other sections of the occupational statement. For example, educational and training qualifications needed to enter an occupation or to obtain professional licenses and certificates often differ among States, regions of the country, and industries in which the occupation is found. Specific job duties and working conditions often are slightly different in various industries and business establishments. And, the extent of trade union membership within an occupation may also vary by industry and area of the country.

The Training, Other Qualifications, and Advancement section is designed to inform the reader about the type of training needed for entering an occupation, and about the requirements for advancement to higher levels. It is important to be aware of the type of training required because it is often necessary early in high school to start planning courses toward that goal.

Variety in Training. Workers can qualify for jobs through a variety of methods, including college training leading to a bachelor's or advanced degree, junior or community college training leading to a certificate or associate degree, public and private post-secondary vocational schools, home study courses, government training programs, Armed Forces, apprenticeship and other formal training offered on-the-job or in the classroom by employers, and in high schools. The *Handbook* identifies which of these routes of entry can be taken in each of the occupations.

The *Handbook* generally presents the minimum level and type of education required for the various occupations and the preferred background for entry. In many cases, alternative ways of attaining required training are also listed in the individual *OOH* statements. Also provided is information on high school and post-high school courses that are of particular help in preparing for the occupations.

Although people with different educational backgrounds may be able to enter an occupation, the level of entry and the speed of advancement are often determined by the amount of training. For example, a high school graduate with clerical skills can enter the medical record field as a clerk and receive about a month of on-the-job training. A graduate of a two-year medical record technician course at a community college can begin his career at the technician level as a supervisor of several clerks. The graduate of a four-year medical record librarian course may enter the medical record profession as the head of the medical record department in a hospital. The chance that the person who starts as a clerk will, after years

of experience, be head of the department is very small, and as more trained people enter the labor force the chance to advance without academic training to the highest positions in any occupation becomes more remote.

In an effort to protect the public, there are State certifications or licensing requirements for some occupations to assure that the workers are qualified. The *Handbook* provides information to help young persons become aware of any special requirements that exist in a specific occupation. Physicians and nurses are examples of professionals who must pass State board exams for licensing. Elementary and secondary school teachers must successfully complete a specified list of courses among their college subjects, depending on the grade level and subject matter they plan to teach. Also, the courses required for a teacher's license differ from State to State. A person who is preparing for an occupation that requires State licensing should, therefore, become familiar with the information on licensing for the occupation that is presented in the *Handbook* and then obtain specific information on the requirements in the State or States in which he or she plans to work. This information will help in gearing courses so the requirements can be met.

When one decides on an occupation, the "continuing education" that will be required in order to reach the desired level in the occupation is as important a consideration as the initial education requirement. A person who sees himself as a college president and begins working as an assistant to the registrar after completing his bachelor's degree should be prepared to spend several years in graduate school. Once the requirements necessary to advance to the desired level of the chosen occupation are determined, the individual should decide whether he or she has the natural talents and personal qualities needed, and whether he or she is willing to put in the time and effort to meet those requirements. If formal education is involved, will the employer pay for it, and if not, can the employee afford the cost? Also, individuals must decide whether they have the academic ability to complete the education.

In addition to the education, training, and other requirements necessary both to enter the occupation and to reach the desired position, another essential factor in career choice is the correlation of specific personal characteristics with the characteristics of the job. To provide this information, the *Handbook* presents typical job characteristics for each occupation. This allows individuals to match their unique qualifications, "likes", and "dislikes" to the job. This is not an easy task, since it is often difficult for young persons to assess themselves. Tests which help individuals assess their personal characteristics can be very valuable.

The number of occupational characteristics that can be related to tangible personal characteristics are numerous. Listed below are some of the job characteristics described in the *Handbook* and the relevant personal characteristics.

Responsible decisions required— Individuals should be able to make important decisions and to exercise good judgment.

Motivates others— Individuals should be able to influence the behavior of others.

Directs the activity of others— Individuals should have supervisory skills.

Work is closely supervised— Individuals must feel comfortable in a situation where work performance is controlled closely by a supervisor.

Highly competitive— Individuals should be able to face the pressures of competing with others on the job for recognition and achievement.

Works with ideas— Individuals should be able to think in abstract terms to solve work related problems.

Works with people— Individuals should have pleasant personalities and the ability to get along with others in face-to-face relationships.

Works with objects— Individuals should have manual skills and some physical coordination.

Works independently— Individuals should have initiative, self-discipline, and organizational ability.

Works as part of a team— Individuals should have the ability to interact with fellow employees in performing duties.

Opportunity for self-expression— Individuals should have creative talents and the ability to utilize their own ideas in practical ways.

Opportunity to see physical results of work— Individuals should derive satisfaction from seeing their work produce a tangible product.

Works with detail— Individuals should enjoy working with technical data, numbers, or written materials on a continuing basis.

Generally is confined to a work area— Individuals should feel comfortable performing their work at one setting.

Work is repetitious— Individuals should be comfortable performing the same task on a continuing basis.

Exposed to weather conditions— Individuals should enjoy working outside, and should not be adverse to exposure to weather and temperature extremes.

Helps people— Individuals should enjoy assisting people in a helping relationship.

The Employment Outlook section informs students and counselors of prospective job opportunities and is, therefore, one of the major aids that

young people can use to evaluate the career potential of the occupations they find interesting. However, the prospect of relatively few job openings should not prevent someone from pursuing a particular career. A student who knows his own interests and has discussed his abilities and aptitudes with his counselor should not forego a potentially rewarding career only because the prospective outlook in that occupation is less favorable than in other occupations. Even in occupations with relatively poor prospects, jobs are available because of the need to replace workers who leave the occupation; on the average, job openings resulting from replacement of workers who leave the occupation account for more than half of all openings.

Outlook information can be very useful to someone who has great interest in a cluster of occupations requiring similar interests, abilities, and educational backgrounds. A student who has become interested in sales occupations, for example, can compare the job prospects for real estate, insurance, automobile, and manufacturer's salesmen and select the one or two offering the best opportunities.

Information about the future outlook in an occupation is very difficult to develop. No one can predict future labor market conditions with perfect accuracy. In every occupation and industry, the ratio between the number of job seekers and the number of job openings constantly changes. A rise or fall in the demand for a product or service affects the number of workers needed to produce it. New inventions and technological innovations create some jobs and eliminate others. Changes in the size or age distribution of the population, work attitudes, training opportunities, or retirement programs determine the number of workers available. As these forces interact in the labor market, some occupations experience a shortage, some a surplus, some a balance between applicants and openings. Methods used by economists to develop information on future occupational prospects differ, and judgments which go into any assessment of the future also differ. Therefore, it is important for users of the *Handbook* to understand what underlies each statement on outlook.

Figure I

Adjective	*Increase*	*Decline*
Very rapid	40.0 percent or more	−40.0 percent or more
Rapid	30.0 percent to 39.9	−30.0 percent to −39.9
Moderate	15.0 percent to 29.9	−15.0 percent to −29.9
Slow	5.0 percent to 14.9	− 5.0 percent to −14.9
Little or no change	0 percent to 4.9	− 0 percent to − 4.9

The keys to understanding the outlook statements are the economic assumptions used in developing projections of future needs. One of the assumptions that underlie the statements on employment outlook in this *Handbook* is that high employment levels will be maintained and that no cataclysmic events will occur, such as a war or a severe and prolonged economic depression. Such catastrophes would, of course, create an entirely different employment situation from that likely to develop under the assumed conditions. But young people would find it impossible to build their lifetime plans in expectation of such unpredictable catastrophes, although, on the basis of historical experience, they must be prepared to weather economic ups and downs during their working lives. The basic economic assumptions are discussed in detail in the introductory section of the Handbook titled Tomorrow's Jobs, and the Technical Appendix of the Handbook.

In making employment projections, all possible factors should be taken into account. Nevertheless, not all factors can be quantified or themselves projected. For this reason, outlook information in the *Handbook* is generally presented as a qualitative statement about growth in an occupation. Opportunities will usually be favorable if employment in occupations increases over time along with the growth of the economy; those occupations that are expected to remain constant or decline generally have less favorable prospects than does the average occupation. The adjectives used to describe changes in employment requirements correspond to the ranges of percent change, as shown in figure I.

For some occupations, it also is possible to make estimates of the future supply of workers. These are usually in professional occupations where the paths of entry are rather limited, and which therefore allow a statistical assessment based on trends in the number of young people pursuing specific types of education or training and entering the occupation related to the training. When supply estimates as well as demand estimates have been made, the *Handbook* chapters contain a qualitative statement of job opportunities corresponding to the demand-supply relationship. (See figure II.)

Figure II

Job opportunities	*Prospective demand-supply relationship*
Excellent	Demand much greater than supply
Very good	Demand greater than supply
Good or favorable	Rough balance between demand and supply
May face competition	Likelihood of more supply than demand
Keen competition	Supply greater than demand

The information in the *Handbook* discusses the outlook for the Nation as a whole. Job prospects in local areas, however, which are of great interest to many young people, may not correspond to those described in the *Handbook*. The *Handbook* cannot discuss the outlook in each locality because the analysis is too much for any centralized staff of researchers to handle. In using the national statements, therefore, young people should discuss with counselors the prospects in the particular areas in which they would like to live. Information is often available on the local outlook from local offices of State employment security agencies.

The Earnings section helps answer many questions young people ask when choosing a career. Will the income be high enough to maintain the desired standard of living? Is the pay high enough to justify the training costs? How much will a worker's earnings increase as he gains experience? In what localities are the best-paying jobs in the occupation?

What are Earnings? To most people, the word "earnings" means money—a paycheck in the mailbox or cash in the pocket. Money, however, is only one kind of financial reward for work. Paid vacations, clean uniforms, and free lunches are also part of the total earnings package. There are three basic kinds of earnings—cash, fringe benefits, and payment in kind.

Cash. In 1972 more than 90 percent of all American workers received cash for their work in the form of a *wage or salary*. A wage or salary is usually a "flat rate"—a certain amount of money for a specific period of time at work. A wage is usually an hourly or daily rate, and a salary is a weekly, monthly, or yearly rate. Most craftsmen, factory workers, and laborers are wage earners, and most professional, technical, and clerical workers are salary earners. Salary workers usually know how large their pay checks will be each week or month, which makes budgeting easier. Wage workers' earnings may be different each week, depending on how many hours they work.

Both wage and salary workers receive *overtime* pay, but this is more common for wage workers. Overtime rates and the standard workweek (the number of hours worked before overtime is paid) vary from job to job. Many employees are covered by the Fair Labor Standards Act, which requires overtime pay at 1-1/2 times the hourly rate for more than 40 hours' work a week. For many workers overtime pay is a relatively large part of their total earnings.

Workers assigned to night shifts or other irregular hours often receive extra pay per hour, called a *shift differential*.

Earnings take a variety of forms besides the familiar rate plus overtime. Waiters and waitresses get most of their earnings in *tips* from customers. Salesmen may receive a *commission*—a percent of the amount of their sales. Factory workers are sometimes paid a *piece rate*, a certain payment for each item they produce. Tips, commissions, piece rates, and other kinds of pay are often combined with flat rate wages and salaries.

Almost 10 percent of all workers in 1972 were in business for themselves and earned *self-employment income* instead of wages or salaries. Self-employment income takes an almost endless variety of forms. Farmers, shopkeepers, and other small businessmen receive money selling their products. Doctors and lawyers collect fees from their clients. Writers sell short stories to magazines or receive royalties from publishing their books.

Some occupations offer the chance to earn income in addition to regular wages and salaries. Seamstresses often take in sewing after shop hours, and college professors are paid for publishing independent research.

Fringe Benefits. In addition to cash, most American workers receive a variety of indirect payments, or *fringe benefits*, ranging from paid holidays to life insurance. The importance of fringe benefits has increased tremendously since World War II, and by 1970 accounted for nearly one-fifth of the total earnings package in private industries other than farming.

Several fringe benefits received by a majority of workers are required by Federal and State law. They include Social Security, Workmen's Compensation, and unemployment insurance. These benefits provide payments to workers who are not employed because of old age, work-related injury or disability, or lack of suitable jobs.

Among the most common fringe benefits are paid time off for vacations, holidays, and sick leave. Some workers also receive time off, usually without pay, for jury duty, military service, and maternity leave.

Some fringe benefits help protect the worker's income if he is injured, sick, unemployed, or retired. These include life, health, and accident insurance, retirement plans, supplemental unemployment benefits, and severance pay. The costs of insurance and retirement are often shared by the worker and employer.

Some employers also offer stock options and profit-sharing plans, saving plans, and bonuses.

Payments in kind. In addition to cash and fringe benefits, some workers receive part of their earnings as goods or services, also called "kind". For example, hired farm hands and private household workers often receive room and board. Other earn-

ings in kind include laundered uniforms, meals, company housing, business expense accounts, and free airline tickets. These items should be considered earnings because they are worth money and come with the job.

Which Jobs Pay the Most? Comparing the earnings in different occupations is not easy, mainly because good information is available only for one category of earnings—wages and salaries. For some occupations even this information is not available. Nevertheless, the *Handbook* provides some types of comparisons in many occupational statements. Generally, these are comparisons among the average earnings of all nonsupervisory wage and salary workers in private industry, except farming, which is the broadest average type of earnings data available in current statistics. Other comparisons are made between similar occupations. For example, a comparison of hourly earnings of different construction craftsmen such as bricklayers, carpenters, and plumbers.

Earning Variations. Within each occupation there are many levels of pay. Earnings vary with the worker's experience, location, industry, and type of work, and in the *Handbook* this information is, when possible, provided.

Experience. Beginning workers nearly always earn less than experienced workers. In most occupations, workers move up a "ladder" to higher pay and generally do more responsible work as they gain experience. Some ladders, especially those in unskilled jobs, have only one or two steps. In other occupations, the ladders have many steps, and many even offer a choice of several different kinds of work with different levels of pay.

The beginning draftsman faces a typical ladder. The average salary for draftsmen in 1970, for example, was $167 a week, but the beginner usually starts out as a tracer at $103. As he gains experience he will advance to be a junior draftsman at $126, senior draftsman at $158, and after many years a lead draftsman at $190. At each higher step in the ladder the draftsman is expected to do more complicated work with less supervision. If the opportunity comes along he might move to a higher paying position as a supervisor or designer.

Location. In most occupations a worker's earnings will vary with the location of his job. The average weekly earnings of lead draftsmen, for example, vary considerably from city to city. (See table 1.) The highest earnings, of the 10 cities listed, occurred in Detroit, where many draftsmen are concentrated in the automobile industry. The lowest earnings shown are in smaller cities in the South and West.

The variations in the earnings of draftsmen, however, do not tell much about such variations in other occupations. Although there are some general national patterns of earnings differentials, each occupation has its own geographical pattern, and each occupation must be studied for its own. Young people using the *Handbook* also should check with counselors and local employers to find out about specific earnings in local areas.

Industry and Type of Work. Workers in most occupations can find jobs in different industries, sometimes doing different types of work. Because the job market is not exactly the same in each situation, the worker can expect his pay to vary according to whom he works for and what he does on the job.

The earnings of senior accounting clerks, for example, vary considerably by industry. As shown in Table 2, accounting clerks averaged $141.50 a week in public utilities and $144.50 in manufacturing, but only $122.00 in retail trade and $123.50 in finance, insurance, and real estate. Those working in service industries and in wholesale trade earned $132.00 and $136.50 a week, respectively.

The salaries of Ph.D. chemists show how earnings may vary by type of work. (See table 3.) In 1972, chemists in management jobs earned $6,700 more than those in research and development. Chemists in marketing and production earned $400 less than research-and-development chemists, but $4,300 more than teachers.

Table 1. Average Weekly Earnings of Lead Draftsmen, 1970-71, by Selected City and Region

City	*Average weekly earnings*
Detroit, Michigan	$295.00
Dayton, Ohio	226.00
Chicago, Illinois	215.50
Houston, Texas	206.00
Seattle, Washington	193.00
Columbus, Ohio	189.50
Salt Lake City, Utah	175.00
Scranton, Pennsylvania	173.00
Raleigh, North Carolina	172.50
Little Rock, Arkansas	162.50
Region	
North Central	213.50
Northeast	202.00
West	199.00
South	192.00
United States	204.00

SOURCE: Bureau of Labor Statistics.

Table 2. Average weekly earnings of senior accounting clerks, by industry, 1971

Industry	*Weekly earnings*
Public utilities	$144.50
Manufacturing	141.50
Wholesale trade	136.50
Services	132.00
Finance, insurance, and real estate	123.50
Retail trade	122.00

SOURCE: Bureau of Labor Statistics.

Table 3. Average annual salaries of chemists, with Ph.D. degrees, by type of work, 1972

Type of work	*Annual salaries*
Management	$26,300
Research and Development	19,600
Marketing and Production	19,200
Teaching	14,900[1]
Other	18,300

[1] Salary for 9-month academic year.

SOURCE: American Chemical Society.

The Working Conditions section provides information that can be most important to an individual's job satisfaction because preferences for working conditions vary considerably among individuals. Some people, for example, have a preference for outdoor work while others prefer working in an office. Some people like the variety of shift work, and others want the steadiness of a 9-to-5-job. Proper consideration of working conditions can contribute greatly to job satisfaction and success.

The *Handbook* discusses many aspects of working conditions that are of concern to individuals who are looking into their prospective careers. The following are several types of working conditions, with their implications, that are discussed in the occupational statements when they apply.

Overtime work required— When overtime is required, employees must give up some of their free time and should therefore be flexible in their personal lives. Overtime, however, provides the opportunity to increase earning power.

Shift Work— Evening or night work is part of the regular work schedule in some jobs. Employees are, therefore, usually working while most other people are off. Shift work may be preferred by some individuals who want to pursue certain daytime hobbies such as hunting, fishing, gardening, etc.

Environment— Work settings vary from clean air-conditioned offices to places that are dirty, greasy, or poorly ventilated. With this knowledge, workers can avoid jobs that may submit them to unpleasant conditions.

Outdoor work— Those who work outdoors may be exposed to weather extremes. It may be preferred over indoor work, however, by those who consider outdoor work healthier.

Hazardous— In some jobs, employees are subject to possible burns, cuts, falls, etc., and must attend to proper safety precautions.

Physical demands— Some jobs require standing, stooping, kneeling, or working in cramped positions. Physical strength and stamina may be required, and those without such attributes should be careful in selecting such jobs.

Young people planning their careers should also consider how working conditions may change in an occupation as they progress up the career ladder. For example, an employee may find that promotion depends on adjusting to working conditions other than what he planned. For example, a young person may enter a particular occupation because outdoor work is appealing, and be disappointed to learn that the next levels of the career ladder are desk jobs.

Sources of Additional Information. People using the *Handbook* may want more detail on the occupations discussed in the individual reports, or information on fields of work that are not covered in this publication. Suggestions as to sources of additional information are given in most of the occupational reports. Several publications of the Bureau of Labor Statistics also provide further information on topics such as earnings, hours of work, and working conditions.

Bureau of Labor Statistics Publications. In addition to this *Handbook* the Bureau of Labor Statistics issues a periodical, the *Occupational Outlook Quarterly*, to keep readers up to date between editions of the *Handbook*, on developments affecting employment opportunities and on the findings of new occupational outlook research. In addition the Bureau issues, at irregular intervals, occupational outlook bulletins that give much more detailed information on various fields of work than can be included in either the *Handbook* or the *Quarterly*.

The Bureau has also developed a visual aid for counselors entitled *Jobs for the 70's*. It consists of a set of 40 color slides that show the changing occupational and industrial mix, and trends in manpower development, education, and training. The slides, which have an accompanying narrative, are available directly from Bureau of Labor Statistics Regional Offices.

The Bureau will be glad to place the name of any user of this *Hand-*

book on its mailing list to receive announcements of new publications and releases summarizing the results of new studies. Anyone wishing to receive such materials should send the request, with his address to the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.

Other Bureau of Labor Statistics publications that are useful to counselors can be purchased from the Government Printing Office in Washington, D.C., or from Bureau of Labor Statistics Regional Offices. A list of these publications, along with descriptions of their contents follows:

Employment and Earnings. Monthly reports featuring timely analysis of current developments in employment, unemployment, hours, and earnings for the Nation. Contains statistics on employment, earnings, hours of work, and labor turnover by industry for the Nation and by industry division for each State and for 202 metropolitan areas. Also, contains detailed statistics on the labor force, including characteristics of the employed and unemployed, such as age, marital status, color, industry, and occupational attachment.

Special Labor Force Reports. Reports based on special surveys of the labor force are issued several times a year. They include statistics and analysis of selected characteristics of the labor force, such as educational attainment, employment of school dropouts and recent high school graduates, work experience during the year, and marital and family status. Published in the *Monthly Labor Review*, which may be available in your school library.

Area Wage Surveys. These reports include figures on average earnings and employment in selected occupations and in major industries and labor market areas. Weekly working hours for some groups of workers and customary practices regarding pensions, vacations, holidays, and sick leave are also reported. A list of surveys is included in the *Directory of Area Wage Surveys*, which may be obtained free from the Bureau of Labor Statistics.

Union Wage Scales. Annual bulletins and releases on minimum wage scales and maximum hours of work at straight-time rates for cities of 100,000 or more population—69 cities in the printing industry, 68 cities in the construction and local trucking industries, and 67 cities in the local transit industry. Quarterly releases on surveys in seven major building trades, in 100 cities, cover averages and increases in wage scale by trade, and wage trends for the industry as a whole.

Monthly Labor Review. The Bureau of Labor Statistics issues the *Monthly Labor Review* which contains articles that can help counselors keep abreast of the changing social, economic, and demographic scene. In addition to providing a statistical section on labor force and employment, labor turnover, earnings and hours, consumer and wholesale prices, and work stoppages, the *Monthly Labor Review* publishes special articles by experts on subjects such as the impact of technological change on employment, occupational counseling, and manpower planning.

The procedure for ordering these reports can be found in the back of the *Handbook*.

Sources of Additional Assistance. The U.S. Office of Education publishes the *Directory of Post Secondary Schools With Occupational Programs, 1971, Public and Private.* This volume contains a program index and lists schools that offer specific occupational training and is a valuable tool for counselors, teachers and students. Other sources likely to be helpful in providing information and assistance are public libraries; schools; State employment services; private personnel agencies; business establishments; and trade unions, employers associations, and professional societies. A brief description of each follows.

Public Libraries. These libraries usually have many books, pamphlets, and magazine articles giving information about different occupations. They also may have several books and current indexes that list the great numbers of publications on occupations, and the librarians may be of assistance in finding the best ones on a particular field of work.

Schools. School libraries and guidance offices also often have extensive reading materials on occupations. In addition, school counselors and teachers usually know of any local occupational information that has been assembled through special surveys made by schools or other community agencies. Teachers of special subjects such as music, printing, and shorthand can often give information about occupations related to the subjects they teach.

Business Establishments. Employers and personnel officers usually can supply information about the nature of the work performed by employees in their own industries or businesses, and about the qualifications needed for various jobs, as well as other facts about employment conditions and opportunities. The names of local firms in a particular industry can be found in the classified sections of telephone directories or can be obtained from local chambers of commerce.

Trade Unions, Employers' Associations, and Professional Societies. Frequently, these organizations have local branches; their officials can supply information relating to the occupations with which they are concerned.

State Employment Services. Counselors in local public employment offices are in a particularly good position to supply information about job opportunities, hiring standards, and wages in their localities. The services available through the public employment offices are described in the following section of this chapter.

Services to jobseekers at public employment offices. Local offices of State Employment Services specialize in finding jobs for workers and workers for jobs. State Employment Services are affiliated with the U.S. Employment Service of the U.S. Department of Labor's Manpower Administration and constitute a Federal-State partnership. Employment and related services are available without charge in every State.

At each of the over 2,400 public Employment Service offices across the Nation, jobseekers are aided in obtaining employment, and employers are assisted in finding qualified workers.

Four basic services are provided to workers by the public Employment Service: (1) Job information; (2) employment counseling; (3) referral to job training; and (4) job placement.

Job Information. The personnel who staff the public Employment Service offices are familiar with their areas and thus know what kinds of workers are employed in local industry, what jobs are available, what hiring requirements and opportunities for advancement are, and the wages that are paid. Job Information Service (JIS) units in many local offices permit job seekers to select their own jobs from a computerized listing of job opportunities in the area. These job listings are updated daily and provide comprehensive information supplied by employers on specific job openings in the area. In addition, the JIS includes a library of general information on occupational trends, industrial developments, and State-Federal government job opportunities, as well as association and union promotional materials. The staff conduct manpower surveys to determine the area's available skills, training needs, and future occupational opportunities. Through the employment service network of offices, information is also available on job opportunities in other areas of the country.

Employment Counseling. Employment counseling assists young people who are starting their careers, as well as experienced workers who wish or need to change their occupation. The major purposes of employment counseling are to help people understand their actual and potential abilities, interests, and personal traits; to know the nature of occupations; and to make the best use of their capacities and preferences in the light of available job opportunities.

The employment counselor is specially trained and has access to a large store of occupational information.

Testing. Most local offices have testing services available which the counselor may use to assist him in appraising an individual's aptitudes, interests, and clerical and literacy skills.

USES aptitude tests are particularly helpful in relating an applicant's potential abilities to the aptitude requirements of 62 broad occupational groupings and hundreds of specific occupations. A Spanish Language and a nonreading edition for individuals with very limited education have also been developed.

Referral to Training. Many individuals seek work for which they lack some qualifications. Sometimes the job requires basic education or a specific skill. Besides referring a jobseeker to a job, the public Employment Service may suggest training for an applicant so that he can qualify for or secure a better job.

Jobs and job requirements change. In today's fast-paced world, important considerations when selecting a vocation are the training required to perform the work, and ways that training need can be met.

Job Placement. A primary objective of the public Employment Service is to place workers in jobs. Regular contact is maintained with local employers to learn about their job openings. Requests are received from employers for many different kinds of workers. As a result, registered applicants have access to a variety of job vacancies with many employers, just as the employer has access to many applicants. This dual function eliminates "hit-or-miss" job hunting.

Special Services to Veterans. Veterans are legally entitled to priority in all services, with preferential treatment for disabled veterans over other veterans. In addition, the Vietnam Era Veterans Readjustment Assistance Act requires that some specific form of assistance designed to enhance employment prospects be given to each veteran who applies to the Employment Service. Each local office has a veterans' employment representative who is assigned the responsibility to see that these priority services are provided by all local office staff.

Special Services for Youth. The Employment Service maintains a year-round program of services to youth, including counseling, job development, placement, training, and referral to other agencies. Special efforts include: (1) In the Summer Employment Program, the Employment Service enlists the cooperation of private and public sectors to help develop as many employment opportunities as possible for disadvantaged youth, to provide valuable summer experience and enable them to return to school in the fall; (2) The ES-School Cooperative Program provides placement-related services to graduating seniors, school dropouts, and potential dropouts who desire to enter the labor market.

Other Special Services. Disadvantaged job seekers who have special problems obtaining employment are provided employment services to help overcome barriers, and this may include referral for supportive services such as child care or health examinations to agencies which provide such services, or referral to training which will help develop the job seeker's employability.

Individuals with mental or physical disabilities which constitute vocational handicaps are given special consideration by the Employment Service. Middle-age and older workers are assisted in making realistic job choices and overcoming problems related to getting and holding jobs. Employers are encouraged to hire individuals on their ability to perform the work. Similar attention is given to the employment problems of minority group members and all others facing special difficulties in obtaining suitable employment.

Community Manpower Service. Jobseekers, employers, schools, civic groups, and public and private agencies concerned with manpower problems are invited to utilize the service of the public Employment Service office in their community, and to avail themselves of the job information in that office. Local offices are listed in the phone book as agencies of the State government.

Private Personnel Agencies. Private personnel agencies can provide a great deal of information and assistance to job seekers. These agencies employ counselors to assist clients with career planning and placement. Because they are located in cities and towns throughout the country, private personnel agencies are often an excellent source of information about occupational opportunities in local areas. The private personnel agencies can be found in local telephone directories and generally charge a fee for their services.

TOMORROW'S JOBS

Young people in an ever growing and changing society are faced with the difficult task of choosing sound career plans from among the thousands of alternatives. As the economy continues to expand, creating more and different kinds of jobs, this planning process becomes more difficult. Making career plans calls for an evaluation of an individual's interests and abilities, as well as for specific information on occupations. This *Handbook* provides students, counselors, teachers, and parents with occupational information.

Several questions are of major importance to young persons as they view the variety of occupational choices open to them. Among these questions are: What fields look especially promising for employment opportunities? What competition can be expected from other workers? What type and how much training and education are required in order to enter particular jobs? How do earnings in certain occupations compare with earnings in other occupations requiring similar training? What types of employers provide which kinds of jobs? What are the typical working conditions associated with particular occupations?

Of importance in evaluating information that answers these and related questions is knowledge of the dynamic changes that are continually occurring in our economy—the trends in the Nation's work force and in its business, industrial, and occupational development. New ways of making goods, new products, and changes in living standards are constantly changing the types of jobs that become available. To throw light on the changing characteristics of occupations and to provide background for understanding the outlook in specific occupations, this chapter focuses on overall patterns of change in the country's industrial and occupational composition. It also discusses the implications of these changes for education and training in relation to occupational choice.

No one can forecast the future. Nevertheless, by using the wealth of information available, extensive economic and statistical analyses, and the best judgment of informed experts, the work future can be described in broad terms. Of course, some aspects of the future can be predicted more accurately than others. For example, the number of 18-year-olds in 1985 can be estimated with a very high degree of accuracy because individuals 5 years old in 1972 are accounted for in our vital statistics, and the death rate of children between 5 and 18 is extremely low and stays about the same from year to year. On the other hand, forecasting employment requirements for automobile assemblers in 1985 is extremely difficult. Employment of these workers can be affected by the changing demand for American-made automobiles, shifts in buyers' preference (toward the compact car, for example), changes in the ways cars are made (more automation or the use of new types of engines), and unpredictable economic developments outside of the automobile industry.

To project the demand for all workers in the economy, specific assumptions have to be made about general economic movements and broad national policy. The picture of the future employment outlook reflected in the *Handbook* is based on the following fundamental assumptions:

1. Maintenance of high levels of employment and of utilization of available manpower in 1985;

2. that no major event such as long-duration or widespread energy shortages will alter substantially the rate of economic growth. (Although energy shortages were being experienced in the economy as this *Handbook* went to press, no conclusive assessments could be made at this time of the magnitude or duration of the shortages or their long-run effect on employment either as a factor stimulating or restricting employment opportunities in specific industries or occupations. Future editions of the *Handbook* will incorporate the significant findings of special studies and reports in this area.)

3. that economic, social, and educational trends will continue to change according to patterns of the recent past;

4. that scientific-technological advancement will continue at about the same rate as in recent years;

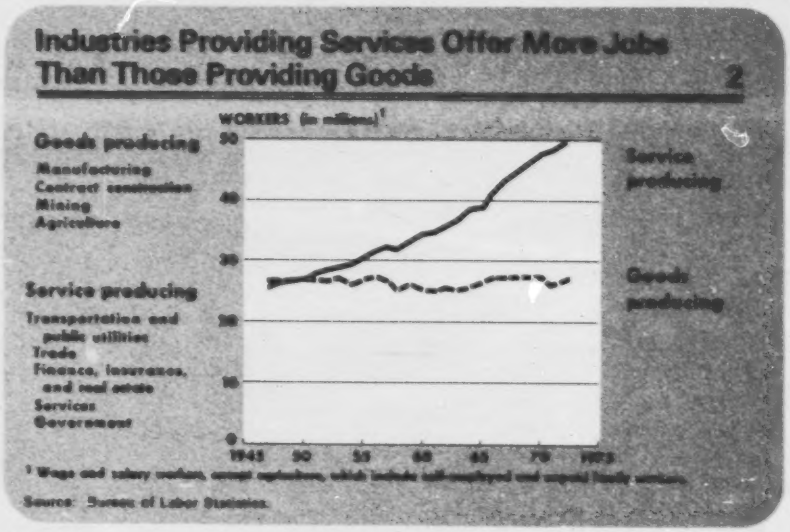
5. that the United States will not be at war, but that there will be no substantial reduction in the defense budget beyond that already in effect.

The *Handbook's* assessment of the 1985 industrial and occupational outlook assumes a projected total labor force of 107.7 million in 1985, all-volunteer Armed Forces of 2.0

million, and a resulting civilian labor force of 105.7 million.

Knowledge of specific industries is necessary because employers seek a wide variety of skills; for example, many different industries employ engineers, salesmen, and secretaries. Employment patterns have shifted considerably over the years and are expected to continue to do so. These changes greatly affect employment opportunities and occupational choices.

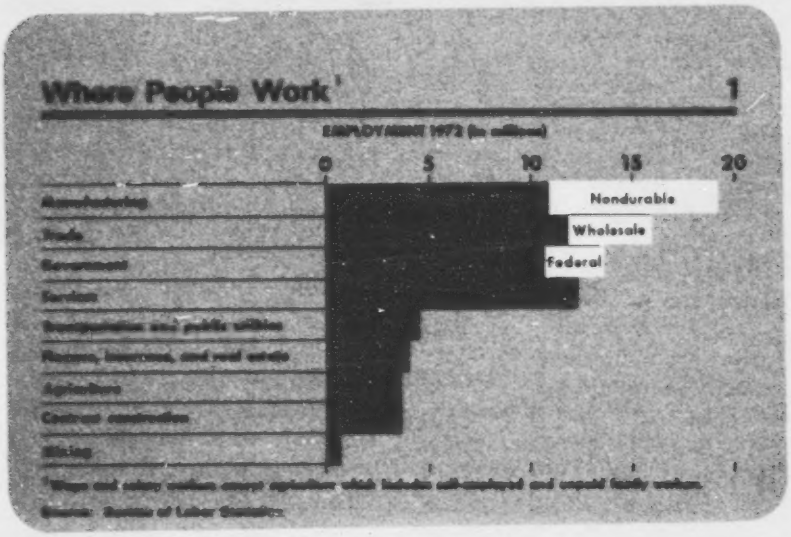
Industrial employment and occupational requirements change as a result of many factors. A new machine or a newly automated process may require different occupational skills or may even create an entirely new occupation; a change in product demand may affect the number of workers needed; an invention may all but eliminate an industry or create a new one.



Industrial Profile

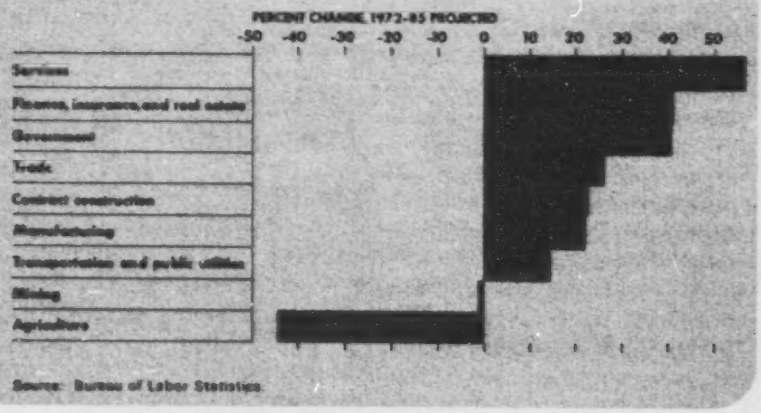
To help understand the Nation's industrial composition, industries may be viewed as either goods-producing or service-producing. They may further be grouped into nine major divisions according to product or service. (See chart 1.)

Most of the Nation's workers are in industries that produce services, in activities such as education, health care, trade, repair and maintenance, and in government, transportation, and banking and insurance service. The production of goods—raising food crops, building, extracting minerals, and manufacturing of goods—has required less than half of the country's work force since the late 1940's. (See chart 2.) In general, job growth through the 1970's is expected to continue to be faster in the service-producing industries than in the goods-producing industries. However, among industry divisions within both the goods-producing and service-producing sectors, the growth pattern will continue to vary. (See chart 3.)



Service-producing industries. In 1972, about 49.7 million workers were on the payrolls of service-producing industries—trade; Government; services and miscellaneous; transportation and other utilities; and finance, insurance, and real estate—about 15.9 million greater than the number employed in 1960. The major factors underlying the rapid growth of the 1960's have been (1) population growth; (2) increasing urbanization with its accompanying need for more city services; and (3) rising income and living standards accompanying demand for improved services, such as health, education, and security. These factors are expected to continue to result in rapid growth of service industries as a group, and they are expected to help employ (8.7 million by 1985, an increase of about 38 percent over the 1972 level.

Through the Mid-1980's Employment Growth Will Vary Widely, by Industry 3



Trade, the largest division within the service-producing industries, has expanded sharply since 1960. Wholesale and retail outlets have multiplied in large and small cities to satisfy the need of an increasingly urban society. Employment in trade was about 15.7 million in 1972, about 38 percent above the 1960 level.

Employment in trade is expected to grow by about 26 percent between 1972 and 1985. Although an ever-increasing volume of merchandise will be distributed as a result of increases in population and consumer expenditures, the rate of increase in manpower needs will be slowed by laborsaving technology, such as the greater use of electronic data processing equipment and automated warehousing equipment, growth in the number of self-service stores, and the growing use of vending machines.

Government employment has grown faster than any other industry division, and has increased by almost three-fifths, from 8.4 million to 13.3 million, between 1960 and 1972. Growth has been mostly at the State and local levels, which together expanded by more than two-thirds. Employment growth has been greatest in agencies providing education, health, sanitation, welfare, and protective services. Federal Government employment increased about 21 percent between 1960 and 1972.

Government will continue to be a major source of new jobs through the mid-1980's. By the mid-1980's employment in Government may be as much as 42 percent higher than in 1972. Most of the growth will be in State and local governments, in which employment needs may rise by 1985 to 16.0 million, about 50 percent higher than the 10.6 million employed in 1972. Federal Government employment is expected to rise slowly to about 2.8 million in 1985, 150,000 or about 6 percent above the 1972 level of 2.7 million.

Service and miscellaneous industries employment has increased rapidly since World War II as a result of the growing need for maintenance and repair, advertising, domestic, and health care services. From 1960 to 1972, total employment in this industry division rose by about two-thirds, from 7.4 million to about 12.3 million.

Service and miscellaneous industries will continue to be among the fastest-growing industries through the mid-1980's. More than half again as many workers are expected to be employed in this industry division in 1985 as in 1972. Manpower requirements in health services are expected to grow rapidly due to population growth and the increasing ability of persons to pay for health care. Business services, including accounting, data processing, and maintenance, also are expected to grow very rapidly.

Transportation and public utility employment in 1972 at 4.5 million was only slightly more than one-tenth higher than in 1960. Different parts of this industry, however, have experienced different growth trends. For example, air travel employment increased rapidly but the railroad industry declined.

The number of jobs in transportation, and in public utilities as a whole, is expected to continue to increase slowly to 1985, and widely differing employment trends will continue to be experienced among individual industries within the division. Rapid increases in employment are expected in air transportation, and a decline is expected to continue in railroad employment, and little or no change is expected in water transportation. Overall employment in this industry division is expected to increase to almost 5.2 million in 1985, 15 percent above the 1972 level.

Finance, insurance, and real estate, the smallest of the service-producing industry divisions, has grown about 47 percent since 1960 to more than 3.9 million in 1972. Employment has grown especially rapidly in banks; in credit agencies; and among security and commodity brokers, dealers, exchanges, and services.

Job growth in finance, insurance, and real estate will keep in step with the overall employment increases of nonfarm employment through the

mid-1980's. Finance, insurance, and real estate employment is expected to expand to nearly 5.6 million by 1985, about 42 percent above 1972 levels.

Goods-Producing Industries. Employment in the goods-producing industries—agriculture, manufacturing, construction, and mining—more than 26.5 million in 1972—has increased slowly in recent years. Significant gains in productivity resulting from automation and other technological developments as well as the growing skills of the work force have permitted large increases in output without corresponding increases in employment. Employment in goods-producing industries is expected to increase to about 30 million in 1985, 13 percent above the 1972 level. However, widely different patterns of employment changes have occurred and will continue among the industry divisions in the goods-producing sector.

Agriculture (farming), which until the late 1800's employed more than half of all workers in the economy, employed only 4 percent, or 3.5 million workers, in 1972. Increases in the average size of farms, rapid mechanization, and improved fertilizers, feeds, and pesticides have created large increases in output at the same time that employment has fallen sharply.

Farming is facing a continuing decline in manpower needs. Factors resulting in past declines will continue, and the outlook is for a 1985 farm work force 45 percent lower than in 1972.

Mining employment, at about 607,000 workers in 1972, has declined by nearly 15 percent since 1960, primarily because of labor-saving technological changes. This trend is likely to continue, and mining is the only nonagricultural industry division that is not expected to increase between 1972 and 1985.

Contract construction employment, at more than 3.5 million in 1972, has increased more than one-fifth since 1960. The Nation's growing need for homes, offices, stores, highways, bridges, dams, and other physical facilities resulted in this increase in employment.

Between 1972 and 1985, employment in contract construction is expected to grow by more than one-fifth to about 4.3 million.

Manufacturing, the largest division within the goods-producing sector that had about 18.9 million workers in 1972, increased about 13 percent in employment between 1960 and 1972. New products for industrial and consumer markets and the rapid growth of the defense-space market have spearheaded the post World War II growth.

Manufacturing employment is expected to increase about 23 percent through the mid-1980's and to reach about 3.2 million in 1985. Employment in durable goods manufacturing is projected to increase slightly faster, and nondurable goods somewhat more slowly than the total. However, the rate of growth will vary among the individual manufacturing industries.

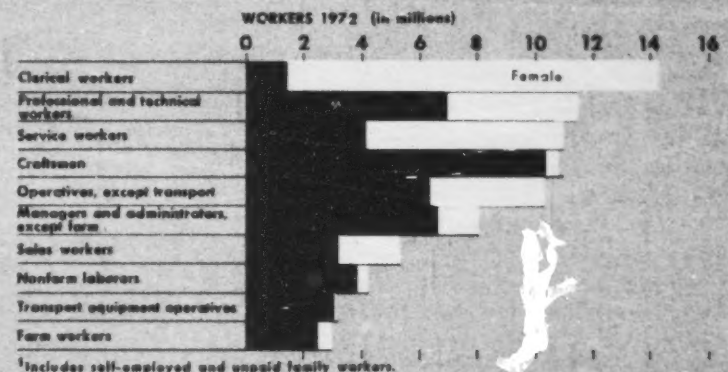
Occupational Profile

As American industries continue to grow larger, more complex, and more mechanized, basic changes will take place in the Nation's occupational structure. Furthermore, occupations will become more complex and specialized. Thus, an imposing and confusing number of occupational choices is provided to individuals who are planning their careers. An individual, in examining the vast number of choices, should first look at broad groupings of jobs that have similar characteristics such as entrance requirements. (See chart 4.)

Among the most significant changes in the Nation's occupational structure has been the shift toward white-collar jobs. In 1956, for the first time in the Nation's history, white-collar workers—professional, managerial, clerical, and sales—outnumbered blue-collar workers—craftsmen, operatives, and laborers. (See chart 5.)

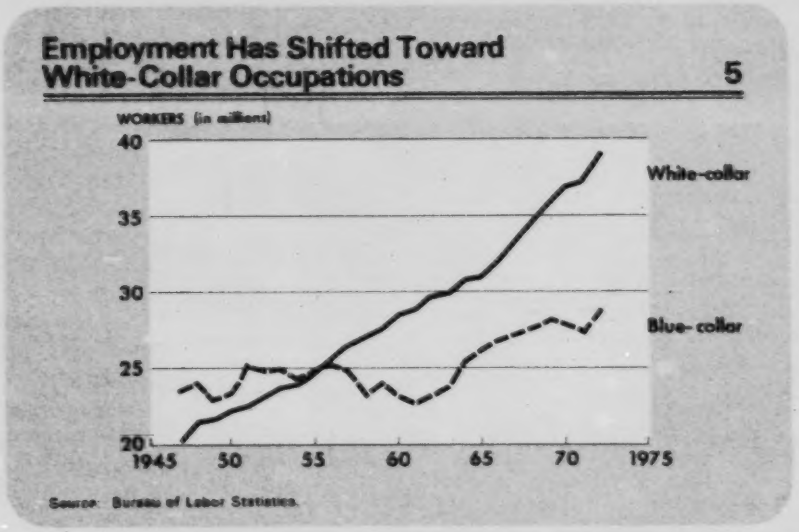
Through the 1970's, we can expect a continuation of the rapid growth of white-collar occupations, a slower-than-average growth of blue-collar occupations, a faster-than-average growth among service workers, and a

Employment in Major Occupational Groups, by Sex 4



[1]Includes self-employed and unpaid family workers.

Source: Bureau of Labor Statistics.



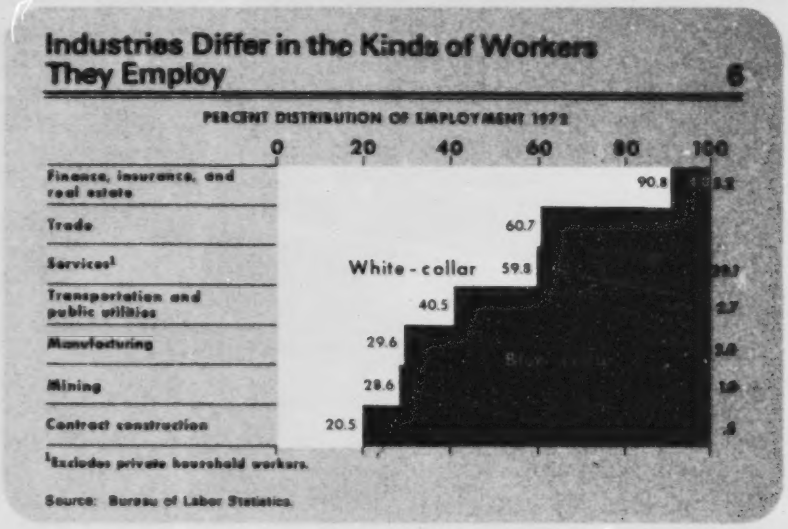
further decline of farm workers. Total employment is expected to increase about 24 percent between 1972 and 1985. In comparison, an increase of about 37 percent is expected for white-collar jobs, and only about 15 percent for blue-collar occupations. By 1985, white-collar jobs will account for more than one-half of all employed workers compared with about 48 percent in 1972. The rapid growth expected for white-collar workers and service workers reflects continuous expansion of the service-producing industries, which employ a relatively large proportion of these workers. The growing demand for workers to perform research and development, to provide education and health services, and to process the increasing amount of paperwork throughout all types of enterprises, also will be significant in the growth of white-collar jobs. The slower-than-average growth of blue-collar and farm workers reflects the expanding use of labor-saving equipment in our Nation's industries and the relatively slow growth of the goods-producing industries that employ large proportions of blue-collar workers. (See chart 6.)

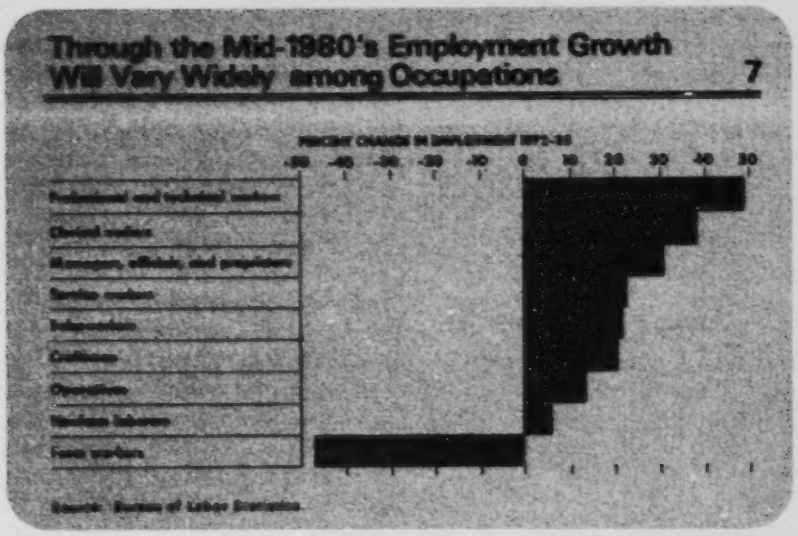
The following section describes in greater detail the changes that are expected to occur among the broad occupational groups through the mid-1980's.

Professional and technical workers, the third largest occupational group in 1972, number about 11.5 million, and include such highly trained personnel as teachers, engineers, dentists, accountants, and clergymen.

Professional occupations will be the fastest-growing occupations from 1972-85. (See chart 7.) Workers in this area will be in great demand as the Nation makes greater efforts toward the country's socio-economic progress, urban renewal, transportation, harnessing the ocean, and enhancing the beauty of the land. The quest for scientific and technical knowledge is bound to grow, and to raise the demand for workers in scientific and technical specialties. The late 1970's and early 1980's will see a continuing emphasis on the social sciences and medical services. By 1985, the requirements for professional, technical, and kindred workers may be almost one-half greater than 1972 employment.

Managers, officials and proprietors totaled about 8.0 million in 1972. As a group they will increase about 30 percent between 1972 and 1985. As in the past, requirements for salaried managers are likely to continue to increase rapidly because of the increasing dependence of business organizations and government agencies on management specialists. On the other hand, the number of self-employed managers is expected to continue to decline as larger businesses continue to restrict growth of the total number of firms,




Through the Mid-1980's Employment Growth Will Vary Widely among Occupations 7
PERCENT CHANGE IN EMPLOYMENT 1972-85
-50 -40 -30 -20 -10 0 10 20 30 40 50
Professional and technical workers
Clerical workers
Managers, officials, and proprietors
Service workers
Craftsmen
Operatives
Nonfarm laborers
Farm workers
Source: Bureau of Labor Statistics

and as supermarkets continue to replace small groceries and general stores.

Clerical workers, numbering 14.2 million in 1972, include workers who operate computers and office machines, keep records, take dictation, and type. Clerical workers made up the largest group of workers in 1972. Many new clerical positions are expected to open up as industries employing large numbers of clerical workers continue to expand. The trend in retail stores toward transferring to clerical workers functions that were performed by salespersons also will tend to increase employment needs of clerical workers. The demand also will be strong for those qualified to handle jobs created by electronic data processing operations. The need for clerical workers as a group is expected to increase by almost two-fifths between 1972 and 1985.

Sales workers, accounting for about 5.4 million workers in 1972, are found primarily in retail stores, wholesale firms, insurance companies, real estate agencies, as well as offering goods door-to-door. Sales workers are expected to increase more than one-fifth between 1972 and 1985.

Increasing sales of many new products resulting from rapid population growth, new product development, business expansion, and rising business levels will be the major reason for increasing employment of sales workers.

Craftsmen, numbering about 10.8 million in 1972, include carpenters, tool and die makers, instrument makers, all-round machinists, electricians, and typesetters. Industrial growth and increasing business activity are the major factors expected to spur the growth of craft occupations through the mid 1980's. However, technological developments will tend to limit the expansion of this group. Craftsmen are expected to increase by about one-fifth, somewhat slower growth than the average for all occupations.

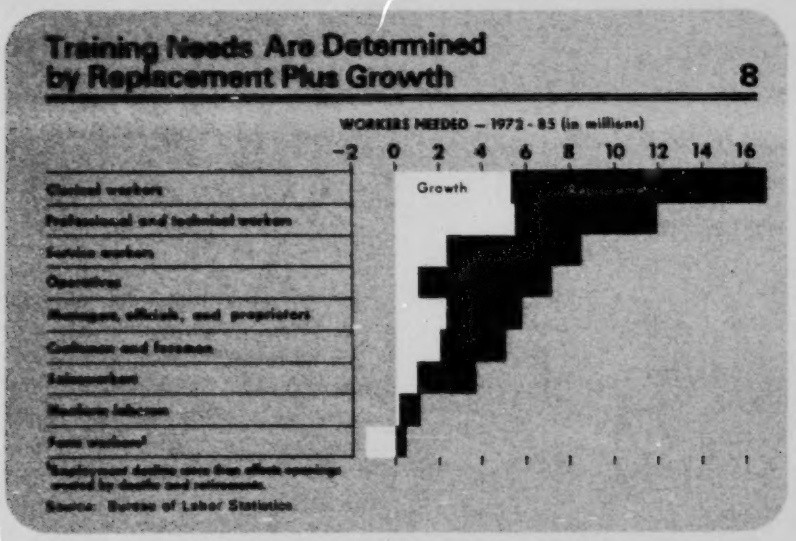
Semiskilled workers (operatives) made up the second largest major occupational group in 1972 with about 13.5 million workers engaged in assembling goods in factories; driving trucks, buses and taxis; and operating machinery.

Employment of semiskilled workers is expected to increase about 13 percent above the 1972 level, despite continued technological advances that will reduce employment for some types of semiskilled occupations. Increases in production generated by rising population and rapid economic growth, as well as the increasing trend toward motor truck transportation of freight, are expected to be major factors contributing to the increasing employment.

Laborers (excluding those in farming and mining), who numbered nearly 4.2 million workers in 1972, for the most part move, lift, and carry materials and tools in the Nation's workplaces. Employment of laborers is expected to increase slightly between 1972 and 1985 in spite of the rises in manufacturing and construction, which employ most laborers. Increased demand is expected to be offset by rising productivity resulting from continued substitution of mechanical equipment for manual labor.

Service workers, including men and women who maintain law and order, assist professional nurses in hospitals, give haircuts and beauty treatments, serve food, and clean and care for our homes, totaled about 11.0 million in 1972. This diverse group will increase about 22 percent between 1972 and 1985. Some of the main factors that are expected to increase requirements for these occupations are the rising demand for hospital and other medical care; the greater need for protective services as urbanization continues and cities become more crowded; and the more frequent use of restaurants, beauty parlors, and other services as income levels rise and as an increasing number of housewives take jobs outside the home.

Farm workers—including farmers, farm managers, laborers, and foremen—numbered nearly 3.1


Training Needs Are Determined by Replacement Plus Growth
8
WORKERS NEEDED — 1972 - 85 (in millions)
−2 0 2 4 6 8 10 12 14 16
Growth
Clerical workers
Professional and technical workers
Service workers
Operatives
Managers, officials, and proprietors
Craftsmen and foremen
Salesworkers
Nonfarm laborers
Farm workers*
*Employment decline more than offsets openings created by deaths and retirements.
Source: Bureau of Labor Statistics

million in 1972. Employment requirements for farm workers are expected to decline to about 1.6 million in 1985. This decrease is anticipated, in part, because of continued improvement in farm technology.

Job Openings

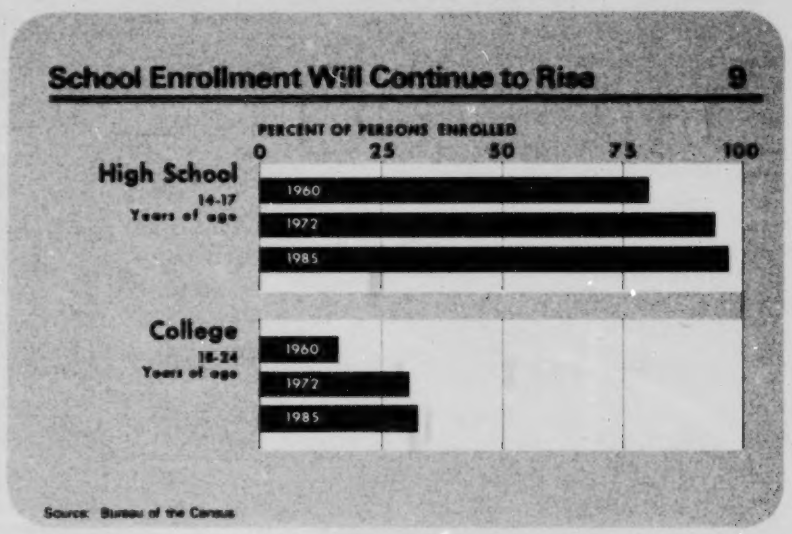
In considering careers, young people should not eliminate occupations just because their preferences will not be among the most rapidly growing. Although growth is a key indicator of future job outlook, more jobs will be created between 1972-85 from deaths, retirements, and other labor force separations than from employment growth. (See chart 8.) Replacement needs will be particularly significant in occupations which have a large proportion of older workers and women. Furthermore, large occupations that have little growth may offer more openings than a fast-growing, small one. For example, among the major occupational groups, openings for operatives resulting from growth and replacement combined will be greater than for craftsmen, although the rate of growth in the employment of craftsmen will be considerably more rapid than the rate of growth for operatives.

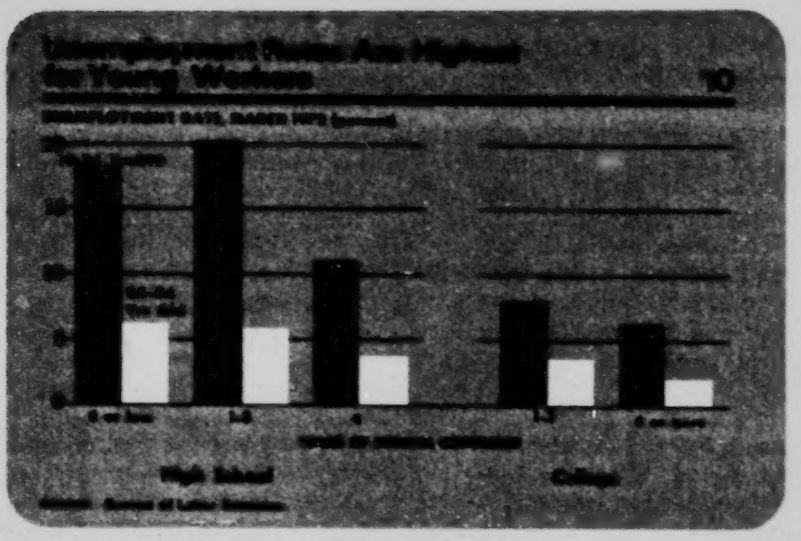
Outlook and Education

Numerous opportunities for employment will be available for jobseekers during the years ahead. Employers are seeking people who have higher levels of education because many jobs are more complex and require greater skill. Furthermore, employment growth generally will be fastest in those occupations requiring the most education and training. For example, professional occupations requiring the most education will show the fastest growth through the mid-1980's. (See chart 7.)

A high school education has become a standard for American workers. Thus, because of personnel practices in American industries, a high school graduate is in a better competitive position in the job market than a nongraduate.

Although training beyond high school has been the standard for some time for many professional occupations, many other areas of work require more than just a high school diploma. As new, automated equipment is introduced on a wider scale in offices, banks, insurance companies, and government operations, skill requirements are rising for clerical and other jobs. Employers increasingly are demanding better-trained workers to operate complicated machinery. In many areas of sales work, new developments in machine design, use of new materials, and the complexity of





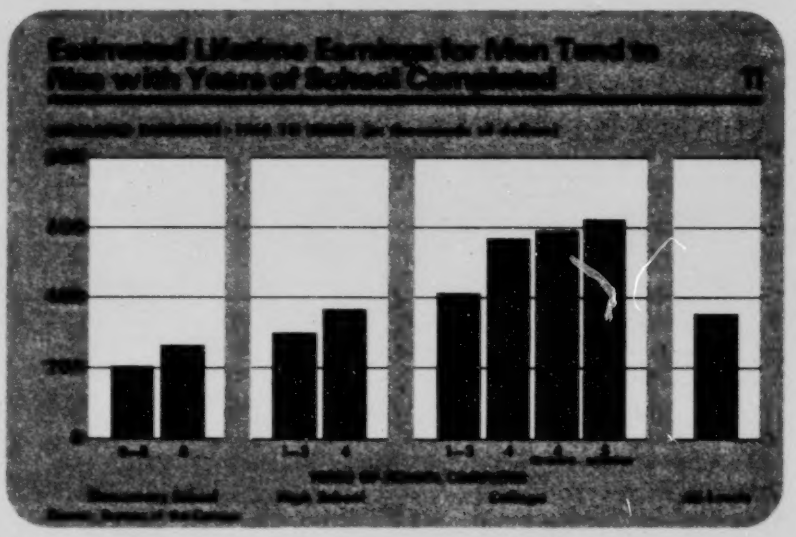
equipment are making greater technical knowledge a requirement for demonstrators; and repairmen must become familiar with even more complicated machines. Because many occupations are becoming increasingly complex and technical, specific occupational training such as that obtained through apprenticeship, junior and community colleges, and post-high school vocational education courses is becoming more and more important to young people preparing for successful careers.

As part of the demand for greater education, the proportion of youth in high school has increased, and an even larger proportion of high school graduates pursue higher education. (See chart 9.) This trend is expected to continue through the mid-1980's.

With so much competition from young people who have higher levels of education, the boy or girl who does not get good preparation for work will find the going more difficult in the years ahead. Employers will be more likely to hire workers who have at least a high school diploma. Furthermore, present experience shows that the less education and training a worker has, the less chance he has for a steady job, because unemployment falls most heavily on the worker who has the least education. (See chart 10.)

In addition to its importance in competing for jobs, education is highly valued in the determination of income. According to the most recently available data, men who had college degrees could expect to earn more than $600,000 in their lifetimes, or nearly three times the $214,000 likely to be earned by workers who had less than 8 years of schooling, nearly twice that earned by workers who had 1 to 3 years of high school, and nearly one and two-thirds as much as high school graduates. Clearly the completion of high school pays a dividend. A worker who had only 1 to 3 years of high school could expect to earn only about $31,000 more than workers who had an elementary school education, but a high school graduate could look forward to a $94,000 lifetime income advantage over an individual completing elementary school. (See chart 11.)

In summary, young people who have acquired skills or good basic education will have a better chance for interesting work, good wages, and steady employment. Getting as much education and training as one's abilities and circumstance permit should therefore be a top priority for today's youth.



THE OUTLOOK FOR OCCUPATIONS

INDUSTRIAL PRODUCTION AND RELATED OCCUPATIONS

Millions of people who work in industrial production help to ensure the continued growth of our economy and its smooth operation. These skilled and semiskilled blue-collar workers are involved in almost every production process.

Workers in this group are employed mostly in factories. Machinists and machine tool operators shape metal to precise sizes. Assemblers put together automobiles, television sets, and hundreds of other products. Inspectors examine and test products to assure quality. Printing craftsmen operate the various types of machinery used to print newspapers, books, and other publications. Some factory workers are not directly involved in the production process, but support it in some way. Stationary engineers, for example, operate boilers and other equipment. Millwrights move and install heavy industrial machinery. Power truck operators move materials about the plant.

Industrial workers also are employed outside of manufacturing in a variety of activities. Automobile painters, for example, restore the finish on old and damaged cars. Photographic laboratory workers develop film and make prints and slides.

Semiskilled workers, such as assemblers and power truck operators, ordinarily need only brief on-the-job training. Skilled workers, such as stationary engineers and machinists, require considerable training to qualify for their jobs. Many learn their trades on the job, but training authorities generally recommend completion of a 3- or 4-year apprenticeship program as the best way to learn a skilled trade.

Most jobs in industrial production do not require a high school diploma. However, many employers prefer high school or vocational school graduates who have taken courses such as blueprint reading and machine shop.

Growth rates for individual occupations in industrial production will differ greatly. Employment of welders, for example, is expected to rise rapidly as a result of growth in the metalworking industries and the wider use of welding. A moderate increase in the number of assemblers is expected, despite the continued automation of assembly processes. Employment in some printing crafts, on the other hand, is expected to decline slowly as a result of more efficient printing methods. Even in declining occupations, however, some job openings are expected as experienced workers retire, die, or transfer to other fields.

This chapter includes statements on 22 industrial production and related occupations. Many other workers who are involved in industrial production are described elsewhere in the *Handbook* because of their close association with particular occupational groups. For example, engineers are included in the chapter on Scientific and Technical Occupations.

FOUNDRY OCCUPATIONS

Foundry workers produce metal castings for numerous industrial and household products that range from machine tools to bathtubs. Casting is a method of forming metal into intricate shapes. Molten metal is poured into carefully prepared molds and allowed to solidify.

The *patternmaker*, the *coremaker*, and the *molder* each play an important part in the process. The *patternmaker* makes a wood or metal model of the casting. A *molder* places it in a box and packs sand around the model to form a mold. If the casting is to have a hollow section, a *coremaker* makes a core of packed and hardened sand that is positioned in the mold before the molten metal is poured in.

In 1972, about 19,000 patternmakers, 56,000 molders, and 23,000 coremakers worked in the foundry industry and foundry departments of other industries such as automobile and machinery manufacturers.

A high school education is the minimum requirement for an apprentice in patternmaking and for more skilled molding and coremaking jobs. An eighth grade education, however, may be enough for entry into many molding and coremaking jobs.

Employment in these trades is expected to show little or no change through the mid-1980's because of automation and other labor-saving improvements in production methods. Nevertheless, the need to replace experienced workers who die, retire, or transfer to other occupations will provide some openings.

Patternmakers, molders, and coremakers are discussed in detail in the following statements. (For a general description of many other jobs involved in metal casting, see the statement on foundries elsewhere in the *Handbook*.)

Sources of Additional Information

For details about training opportunities for patternmakers, coremakers, and molders, contact local foundries, the local office of the State employment service, the nearest office of the State apprenticeship agency, or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Information also is available from the following organizations:

American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill. 60016.

Cast Metals Federation, Cast Metals Federation Building, 20611 Center Ridge Road, Rocky River, Ohio 44116.

International Molders' and Allied Workers' Union, 1225 East McMillan St., Cincinnati, Ohio 45206.

PATTERNMAKERS

Nature of the Work

Foundry patternmakers are highly skilled craftsmen who make the patterns used in making molds for metal castings. Most of the workers in the occupation are *metal patternmakers* (D.O.T. 600.280); a somewhat smaller number are *wood patternmakers* (D.O.T. 661.281). Some patternmakers work with both metal and wood as well as plaster and plastics.

Patternmakers work from blueprints prepared by engineers. They make a precise pattern for the product, carefully checking each dimension with instruments such as micrometers and calipers. Precision is important because any imperfections in the pattern will be reproduced in the castings made from it.

Wood patternmakers select the wood stock, lay out the pattern, and saw each piece of wood to size. They then shape the rough pieces into final form with various woodworking machines, such as lathes and sanders, as well as many small hand tools. Finally, they assemble the pattern segments by hand, using glue, screws, and nails.

Metal patternmakers prepare patterns from metal stock or from rough castings made from a wood pattern. To shape and finish the patterns, they use many metalworking machines, including lathes, drill presses, shapers, milling machines, power hacksaws, and grinders. They also use small hand tools.

Training, Other Qualifications, and Advancement

Apprenticeship is the best means of qualifying as a journeyman patternmaker. Because of the high degree of skill and the wide range of knowledge needed for patternmaking it is difficult to learn the trade on the job. In some instances, skilled machinists have been able to transfer to metal patternmaking with additional on-the-job training or experience. Trade school courses in

Patternmakers work from blueprints.

patternmaking provide useful preparation for the prospective apprentice, and may be credited toward completion of the apprenticeship.

The usual apprenticeship period for patternmaking is 5 years. Each year at least 144 hours of classroom instruction in related technical subjects normally are provided. Apprenticeship programs for wood and metal patternmaking are separate. Employers generally require apprentices to have at least a high school education.

Apprentice patternmakers begin by helping journeymen in routine duties. They make simple patterns under close supervision and, as they progress, the work becomes increasingly complex and the supervision more general. Patternmakers earn higher pay as their skill increases and some become foremen or supervisors.

Patternmaking, although not strenuous, requires considerable standing and moving about. Manual dexterity is especially important because of the precise nature of the work. The ability to visualize objects in three dimensions is also important.

Employment Outlook

Employment of foundry patternmakers is expected to show little or no change through the mid-1980's despite the anticipated increases in foundry production Some openings will arise each year because of the need to replace experienced patternmakers who retire, die or transfer to other occupations. Most of these openings will be for metal patternmakers.

The need for patternmakers will not keep pace with increases in the production of castings because of the greater use of metal patterns. These patterns can be used many times, reducing the number of individual patterns needed.

Because patternmakers learn either basic metalworking or woodworking they are prepared for jobs in related fields when patternmaking employment is not available. Wood patternmakers can qualify for woodworking jobs, such as cabinetmakers, and metal patternmakers can transfer their skills to metalworking jobs such as machinist.

Earnings and Working Conditions

Patternmakers generally have higher earnings than other production workers in manufacturing. In January 1972, average straight-time hourly earnings of wood patternmakers ranged from $4.35 in steel, gray iron and malleable iron foundries, to $4.85 in non-ferrous foundries, according to a wage survey made by the National Foundry Association. Metal patternmakers earnings were generally higher. In comparison, all production workers in manufacturing averaged $3.71 an hour.

Patternmakers work indoors in well-lighted, well-ventilated areas. The rooms in which they work are generally separated from the areas where the casting takes place, so they are not exposed to the heat and noise of the foundry floor.

For sources of additional information, see the introductory section of this chapter.

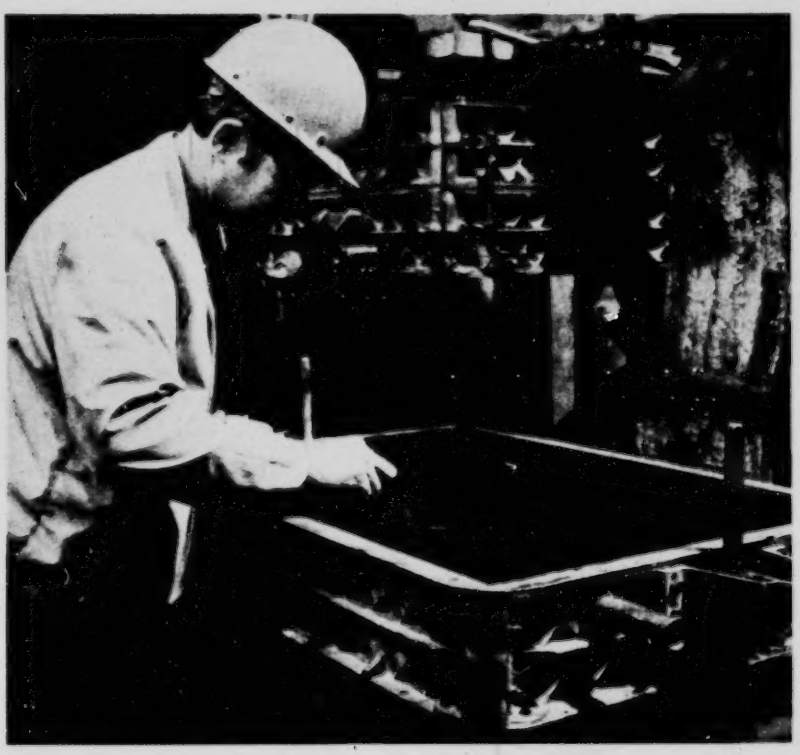
MOLDERS

Nature of the Work

The molder prepares a mold which contains a hollow space in the shape of the item to be made. The mold is made by packing and ramming specially prepared sand around a pattern—a model of the object to be duplicated—in a box called a flask. A flask is usually made in two parts which can be separated to remove the pattern without damaging the mold cavity. When molten metal is poured into the cavity, it soldifies and forms the casting. A molder uses pneumatic-powered rammers and handtools to pack and smooth the sand in the molds.

Most of the workers in this occupation are machine molders; the rest are hand molders. *Machine molders* (D.O.T. 518.782) operate machines that simplify and speed the making of large quantities of identical sand molds. Machine molders assemble the flask and pattern on the machine table, fill the flask with prepared sand, and operate the machine with levers and pedals. Many of these workers set up and adjust their own machines.

Hand molders use mainly manual methods to make the sand molds. Power tools, such as pneumatic rammers, and handtools, such as trowels and mallets, are used to smooth the sand. Molds for small castings are usually made on the workbench by *bench molders* (D.O.T. 518.381); those for large and bulky castings are made on the foundry floor by *floor molders* (D.O.T. 518.381). An all-round hand molder makes many different types of molds. A less skilled molder specializes in a few simple types.



Molder makes sand mold.

Training, Other Qualifications, and Advancement

Completion of a four-year apprentice program, or equivalent experience, is needed to become a journeyman hand molder. Workers with this training are also preferred for some kinds of machine molding but in general a shorter training period is required in order to become a qualified machine molder. Molders' helpers and less-skilled hand molders frequently learn molding skills informally on the job. However, this way of learning the trade takes longer and is less reliable than apprenticeship.

An eighth grade education usually is the minimum requirement for apprenticeship. Many employers, however, require additional education up to and including high school graduation for apprenticeship in skilled hand molding or machine molding jobs.

Apprentices, under close supervision by journeymen, begin with simple jobs such as shoveling sand. Gradually they take on more difficult and responsible work, such as ramming molds, withdrawing patterns, and setting cores. They also learn to operate the various types of molding machines. Beginning with simple shapes and advancing to more complex work, they make complete molds as training progresses. In addition, the apprentice may work in other foundry departments to develop all-round knowledge of foundry methods and practices. The apprentice usually receives at least 144 hours of classroom instruction each year in subjects such as shop arithmetic, metallurgy, and shop drawing.

Hand molders who do highly repetitive work usually learn their jobs during a brief training period. Trainees work with a molder to make a particular kind of mold. After 2 to 6 months, the trainee usually is capable of making a similar mold. Most machine molding jobs can be learned in 2 to 3 months on the job.

Physical standards for molding jobs are fairly high. Hand molders stand at their work, move about a great deal, and do frequent lifting. They need good vision and a high degree of manual dexterity. Since molding work is strenuous few women are employed. Molders may advance to a specialized molding job or eventually to a supervisory position.

Employment Outlook

Employment of molders is expected to show little or no change through the mid-1980's. The trend to more machine molding and the increasing use of permanent and shell molds will limit employment growth. Nevertheless, the need to replace experienced molders who retire, die, or transfer to other occupations will provide some openings.

Earnings and Working Conditions

In January 1972, floor molders averaged $3.85 an hour and bench molders averaged $3.55, according to a wage survey made by the National Foundry Association. By comparison, production workers in all manufacturing industries averaged $3.71 an hour.

Working conditions vary considerably from one foundry to another. Heat and fumes have been greatly reduced in many plants by the installation of improved ventilation systems and air-conditioning.

For sources of additional information, see the introductory section of this chapter.

COREMAKERS

Nature of the Work

Coremakers prepare the "cores" that are placed in molds to form the hollow sections in metal castings. The poured metal solidifies around the core, so that when the core is removed the desired cavity or contour remains.

A core may be made either by hand or machine. In both instances, sand is packed into a block of wood or metal in which a space of the desired size and shape has been hollowed out. After the core is removed from this box it is hardened by baking or by another drying method. When hand methods are used the coremaker uses mallets and other handtools to pack sand into the core box. Small cores are made on the workbench by *bench coremakers* (D.O.T. 518.381) and large ones are made on the foundry floor by *floor coremakers* (D.O.T. 518.381).

Machine coremakers (D.O.T. 518.885) operate machines that make sand cores by forcing sand into a core box. Some machine coremakers are required to set up and adjust their machines and do finishing operations on the cores. Others are primarily machine tenders. They are closely supervised and their ma-

Coremakers build sand core for metal casting.

chines are adjusted for them. (To see how the coremaker's job is a basic step in the casting process, read the description of sand casting given in the statement on foundries elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Completion of a 4-year apprentice training program or the equivalent experience is needed to become a skilled hand coremaker. Apprenticeships also are sometimes required for the more difficult machine coremaking jobs. Apprenticeship training in coremaking and molding are often combined.

Apprentices, working with journeymen coremakers, are assigned routine duties before they make simple cores and operate ovens. As their skill increases apprentices make more complex cores. Classroom instruction covering subjects such as arithmetic and the properties of metals generally supplement on-the-job training. Coremakers earn higher pay as their skill increases, and some become foremen or supervisors.

An eighth grade education usually is the minimum required for coremaking apprentices; some employers require graduation from high school. For less skilled coremaking jobs, inexperienced workers may be hired or other foundry workers upgraded. Some types of hand coremaking require a high degree of manual dexterity. Light coremaking is not strenuous and women frequently are employed.

Employment Outlook

Employment of coremakers is expected to show little or no change through the mid-1980's. Despite the anticipated increase in foundry production employment growth in this occupation will be limited as more cores are made by machine instead of by hand. Nevertheless, several hundred job openings will arise each year because of the need to replace experienced coremakers who retire, die, or transfer to other occupations.

Earnings and Working Conditions

In January 1972, the average hourly earnings of floor coremakers were $3.85; bench coremakers, $3.65; and machine coremakers, $3.25, according to a wage survey made by the National Foundry Association. By comparison, production workers in all manufacturing industries averaged $3.71 an hour.

Working conditions vary considerably from one foundry to another. Heat and fumes have been greatly reduced in many plants by the installation of improved ventilation systems and air-conditioning. Although the injury rate in foundries is higher than the average for manufacturing, coremaking is one of the least hazardous foundry jobs.

For sources of additional information, see the introductory section of this chapter.

MACHINING OCCUPATIONS

Nearly every product made by American Industry contains metal parts or is manufactured by machines made of metal parts. In 1972, about 1.1 million machinists, machine tool operators, tool and die makers, instrument makers, and setup men used a wide variety of machine and hand tools to shape these metal parts.

A machine tool is a stationary, power-driven device that holds and brings together the cutting instrument (tool) and the metal to be cut. Some of the most common machine tools are lathes and machines that drill, bore, mill, and grind. Metal also can be shaped by using chemicals, electricity, magnetism, sound, light, and liquids under controlled conditions.

Motors, farm machinery, and typewriters are among the wide variety of metal products with interchangable parts that are mass-produced and easily assembled from drawings and blueprints. Precision instruments are frequently used to check the accuracy of metal parts that may be machined to tolerances of 10 millionths of an inch.

All-round machinists can operate most types of machine tools, whereas machine tool operators generally work with only one kind. Tool and die makers make dies (metal forms) for presses and diecasting machines, devices to guide drills into metal, and special gages to determine whether the work meets specified tolerances. Instrument makers use machine tools to produce highly accurate instrument parts from metal and other materials. Setup men adjust tools for semiskilled machine tool operators to run. (Detailed discussions of work performed, training, and earnings of these occupations are presented in the chapters that follow.)

ALL-ROUND MACHINIST

(D.O.T. 600.280, .281, and .381)

Nature of the Work

The all-round machinist, who can set up and operate most types of machine tools, uses these tools to make metal parts. Because he plans and carries through all operations, he may switch from one product to another and give variety to his work. His knowledge of metals and machine tools enables him to turn a block of metal into an intricate part of precise specifications. He selects the tools and materials for each job and plans the cutting and finishing operations from a blueprint or written specifications. He makes standard shop computations relating to dimensions of work and machining specifications. He often uses precision-measuring instruments, such as micrometers, to measure the accuracy of his work to thousandths or even millionths of an inch. After completing machining operations, he may use hand files and scrapers before he assembles the finished parts with wrenches and screwdrivers.

Machinists who make and repair metal parts in maintenance departments must have a broad knowledge of the way machines work to adjust and test parts. In plants that produce large numbers of metal products, highly skilled machinists specialize in layout work and mark specifications on metal for machine tool operators who do the machining operations.

Places of Employment

An estimated 320,000 machinists were employed in 1972. Almost every factory using substantial amounts of machinery employed all-around machinists to maintain its mechanical equipment. Some all-round machinists made large quantities of identical parts in production departments of metalworking factories; others made limited numbers of varied products in machine shops. Most all-round machinists worked in the following industries: Machinery, including electrical; transportation equipment; fabricated metal products; and primary metals. Other industries employing substantial numbers of these workers were the railroad, chemical, food processing, and textile industries. The Federal Government also employed all-round machinists in Navy yards and other installations.

Machinists have great flexibility in their work because all types of machinery in nearly every locality re-require their skills.

Training, Other Qualifications, and Advancement

A 4-year apprenticeship is the usual way to learn the machinist trade, but some companies have training programs for single purpose machines that require less than 4 years. Many machinists, however, learn on the job.

A young person interested in becoming a machinist should be mechanically inclined and temperamentally suited to do highly accurate work that requires concen-

Machinist drills to close tolerance.

tration as well as physical effort. A prospective machinist should be able to work independently. Although the work is sometimes tedious and repetitious, the all-round machinist frequently has the satisfaction of seeing the final results of his work.

A high school or vocational school education, including mathematics, physics, or machine shop training, is desirable. Some companies require experienced machinists to take additional courses in mathematics and electronics, at company expense, so that they can service and operate numerically controlled machine tools. In addition, equipment builders generally provide training in the electrical, hydraulic, and mechanical aspects of machine-and-control systems.

A typical machinist apprentice program lasts 4 years and consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. In shop training, the apprentice learns chipping, filing, hand tapping, dowel fitting, riveting, and the operation of various machine tools. In the classroom, he studies blueprint reading, mechanical drawing, shop mathematics, and shop practices.

All-round machinists have numerous opportunities. Many advance to foreman or supervisory jobs. Some take additional training and become tool and die or instrument makers. A skilled machinist may open his own shop or advance into other technical jobs in machine programing and tooling.

Employment Outlook

The number of all-round machinists is expected to increase moderately through the mid-1980's as a result of the anticipated expansion of matalworking activities. Most job openings will arise from the need to replace experienced machinists who retire, die, or transfer to other fields of work.

The demand for machinists will be affected by two main factors. As population and income rise, so will the demand for machined goods, such as automobiles, household appliances, and industrial products. Partially offsetting this, however, will be worker-productivity increases resulting from technological developments.

Chief among these technological innovations is the expanding use of numerically-controlled machine tools. These machines, which translate numbers into a series of motions or processes, significantly reduce the time required to perform machining operations.

Much of the employment growth will occur in maintenance shops, as industries continue to use a greater volume of complex machinery and equipment. Skilled maintenance machinists are needed to prevent costly breakdowns in highly mechanized plants. In such plants, a breakdown of one machine may stop many other machines.

Earnings and Working Conditions

The earnings of machinists compare favorably with those of other skilled workers. Average hourly rates for machinists in 15 areas surveyed in 1972-73 are shown in the accompanying tabulation on the following page.

Machinists must follow strict safety regulations when working around

high-speed machine tools. Short-sleeve shirts, safety glasses, and other protective devices are required to reduce accidents. Most shops are clean and workplaces are well-lighted.

Area	*Hourly Rate*
Boston	$4.71
Buffalo	5.34
Chicago	5.60
Cleveland	5.09
Denver	4.96
Detroit	6.06
Greensville, S.C.	3.60
Houston	5.35
Huntsville, Ala.	5.27
Los Angeles—Long Beach	5.28
Louisville	5.64
Minneapolis—St. Paul	5.57
New York	5.52
Portland, Oreg.	5.92
San Francisco—Oakland	4.62

Companies employing machinists generally provide paid vacations and holidays. Other fringe benefits frequently included health and life insurance, accident insurance, supplemental unemployment benefits, and pensions.

Many machinists are members of unions including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

Sources of Additional Information

The National Machine Tool Builders Association, 7901 Westpark Dr., McLean, Va. 22101—whose members build a large percentage of all machine tools used in this country—will supply, on request, information on career opportunities in the machine tool industry.

The National Tool, Die and Precision Machining Association, 9300 Livingston Rd., Oxon Hill, Md. 20022, offers information on apprenticeship training, including Recommended Apprenticeship Standards for Tool and Die Makers, certified by the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The Tool and Die Institute, 777 Busse Highway, Park Ridge, Ill. 60068—a trade association—offers information on apprenticeship training in the Chicago area.

Many local offices of State employment services provide free aptitude testing to persons interested in becoming all-round machinists or tool and die makers. The State employment service also may be a source of information about training opportunities under the Manpower Development and Training Act. In addition, the State employment service refers applicants for apprentice programs to employers. In many communities, applications for apprenticeship also are received by labor-management apprenticeship committees.

Apprenticeship information also may be obtained from the following unions (which have local offices in many cities):

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, Skilled Trades Department, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

International Brotherhood of Electrical Workers, 1125 15th St NW., Washington, D.C. 20005.

INSTRUMENT MAKERS (MECHANICAL)

(D.O.T. 600.280)

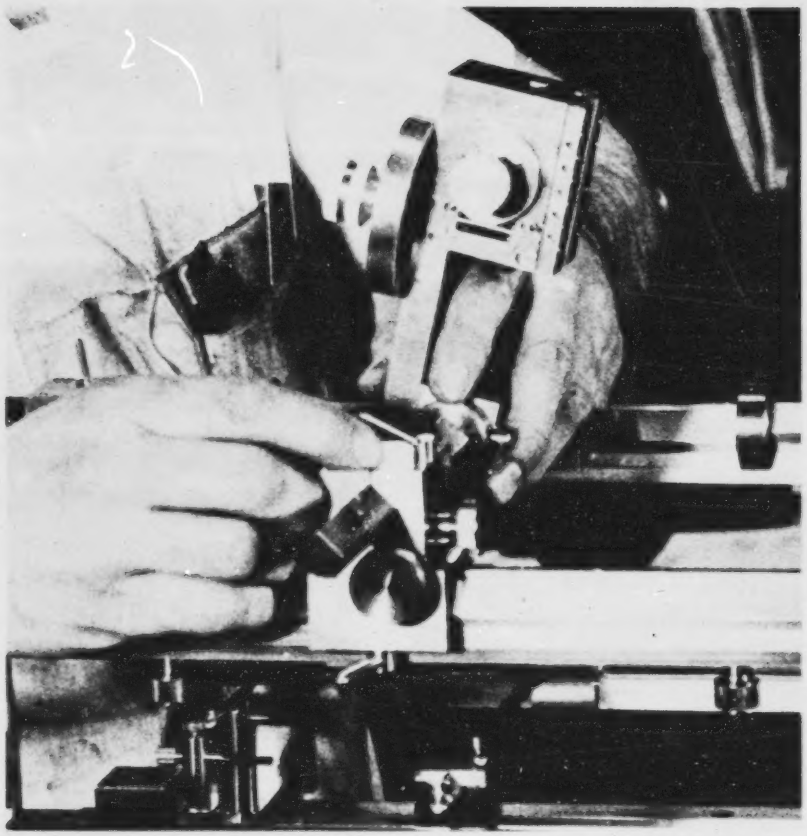
Nature of the Work

Instrument makers (also called experimental machinists and model-makers) work closely with engineers and scientists in translating designs and ideas into experimental models, special laboratory equipment, and custom instruments. Experimental devices constructed by these craftsmen are used, for example, to regulate heat, measure distance, record earthquakes, and control industrial processes. The parts and models may range from simple gears to intricate parts of navigation systems for guided missiles. Instrument makers also modify existing instruments for special purposes.

Instrument makers fabricate metal parts using machine tools (such as lathes and milling machines) and handtools (such as files and chisels). Because accuracy is important, they measure finished parts with a wide variety of precision-measuring equipment, including micrometers, verniers, calipers, and dial indicators, as well as standard optical measuring instruments.

Using considerable imagination and ingenuity, they work from rough sketches, verbal instructions, or ideas, as well as from detailed blueprints. Sometimes specifications must not vary more than ten millionths of an inch. To meet these standards, they commonly use special equipment or precision devices, such as the electronic height gauge, that other machining workers seldom use. They also work with a variety of materials, including plastics and rare metals such as titanium and rhodium.

An instrument maker may construct, assemble, and then test all



Instrument makers must work with detail.

parts of an instrument in small shops. When working with electrical and electronic components that are to be incorporated into an instrument, however, they frequently work with other instrument makers or electronic specialists.

Places of Employment

Many of the approximately 5,000 instrument makers employed in 1972 worked for firms that manufactured instruments. Others were in research and development laboratories that make special devices for scientific research. The Federal Government employed many instrument makers.

The main centers of instrument making are located in and around a few large cities, particularly New York, Chicago, Los Angeles, Boston, Philadelphia, Washington, Detroit, Buffalo, Cleveland, and Rochester.

Training, Other Qualifications, and Advancement

Some instrument makers advance from the ranks of machinists or skilled machine tool operators. These craftsmen, working at first under close supervision and doing the simpler jobs, usually need 1 to 2 years or more of instrument shop experience to qualify as instrument makers.

More frequently, instrument makers learn their trade through apprenticeships that generally last 4 years. A typical 4-year program includes 8,000 hours of shop training and 576 hours of related classroom instruction. Shop training emphasizes the use of machine tools, hand tools, and measuring instruments, and the working properties of various materials. Classroom instruction covers related technical subjects such as mathematics, physics, blueprint reading, chemistry, metallurgy, electronics, and fundamental instrument design. The apprentice must learn enough shop mathematics to plan his work and to use formulas. A basic knowledge of mechanical principles is needed in solving gear and linkage problems.

For apprenticeship programs, employers generally prefer high school graduates who have taken algebra, geometry, trigonometry, science, and machine shop work. Further technical schooling in electricity and electronics is often desirable, and may make possible future promotions to technician positions.

A person interested in becoming an instrument maker should have a strong interest in mechanical subjects and better-than-average ability to work with his hands. He must have initiative and resourcefulness because instrument makers often work alone under minimum or no supervision. Since the instrument maker often faces new problems, he must be able to develop original solutions. Frequently, he must visualize the relationship between individual parts and the complete instrument, and must understand the principles of the instrument's operation. Because of the nature of his job, the instrument maker has to be very conscientious and take considerable pride in creative work.

As the instrument maker's skills and knowledge improve, he may ad-

vance to more responsible positions. Up to 10 years' experience is required to rise to the top skill level. By gaining additional training beyond the high school level in subjects such as physics and machine design, some instrument makers may advance to technician jobs. In these jobs, they plan and estimate time and material requirements for the manufacture of instruments or provide specialized support to professional personnel. Others may become supervisors and train less skilled instrument makers.

Employment Outlook

Employment of instrument makers is expected to increase moderately through the mid-1980's as a result of an expected expansion of metalworking activities and the growing use of instruments in manufacturing processes and research and development work. However, since this occupation is relatively small, only a small number of openings will result in any one year.

Growing numbers of instrument makers will be needed to make models of new instruments for mass-production and also to make custom or special instruments, particularly in the expanding field of industrial automation. Also, more versatile and sensitive precision instruments can be expected to emerge from current research and development programs.

Earnings and Working Conditions

Earnings of instrument makers compare favorably with those of other highly skilled metalworkers. In 1972, instrument makers generally earned between $4 and $6 an hour for a standard workweek.

Instrument shops usually are clean and well-lighted, with temperatures strictly controlled. Instrument assembly rooms are sometimes known as "white rooms," for almost sterile conditions are maintained.

Serious work accidents are not common, but machine tools and flying particles may cause finger, hand, and eye injuries. Safety rules generally require the wearing of special glasses, aprons, tightly fitted clothes, and short-sleeve shirts; neckties are prohibited.

Most companies that employ instrument makers provide paid holidays and vacations. Other nonwage benefits frequently include health, accident, and life insurance, and a pension plan.

Many instrument makers are union members. Among the union represented are the International Association of Machinists and Aerospace Workers; the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio and Machine Workers; and the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America.

Sources of Additional Information

See list under this same heading in the statement on all-round machinists.

MACHINE TOOL OPERATORS

(D.O.T. 602., 603., 604., 605., and 606.)

Nature of the Work

Many machine tool operators do simple, repetitive jobs that can be learned quickly on one or two types of machine tools. Other more skilled workers do complex and varied machining operations on several different machine tools.

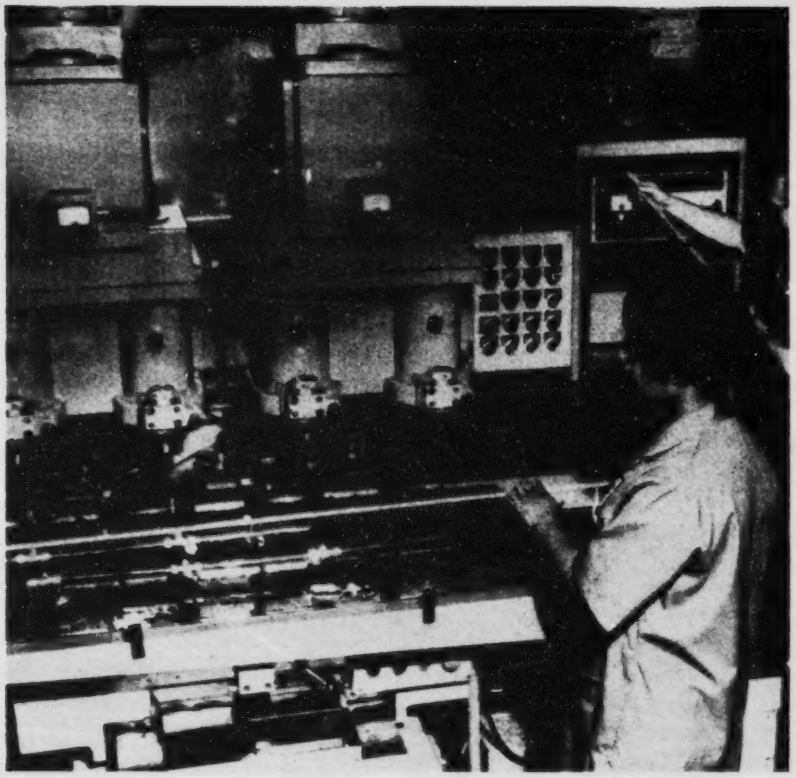
Typically, the semiskilled operator places rough metal stock in a machine tool on which the speeds and operation sequence already have been set. By using special, easy-to-use gages, he watches the machine and makes minor adjustments. However, he depends on skilled machining workers for major adjustments when the machine is not working properly.

A skilled machine tool operator usually works on a single type of machine and does little or no hand fitting and assembly work. He plans and sets up the correct sequence of machining operations according to blueprints, layouts, or other instructions. He adjusts speed, feed, and other controls, and selects the proper cutting instruments or tools for each operation. Using micrometers, gauges, and other precision-measuring instruments, he checks his completed work with the tolerance limits given in the specifications. He also may select cutting and lubricating oils to cool metal and tools during machining operations.

Operators use lathes; drill presses; and boring, grinding, milling, and automatic screw machines. Both skilled and semiskilled operators have job titles related to the kind of machine they operate, such as engine lathe operator, milling machine operator, and drill press operator.

Places of Employment

About 545,000 machine tool operators were employed in 1972, mainly in factories that produce fabricated metal products, transportation equipment, and machinery in large quantities. Skilled machine tool operators worked in production departments, maintenance departments, and toolrooms.



Machine tool operator oversees numerically controlled machining operation.

Machine tool operators worked in every State and in almost every city in the United States.

Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. A beginner usually starts by observing a skilled operator at work. When the trainee first operates a machine, he is supervised closely by a more experienced worker. The beginner learns how to use measuring instruments and to make elementary computations needed in shop work. He gradually acquires experience and learns to operate a machine tool, read blueprints, and plan the sequence of machining work.

Individual ability and effort largely determine the time required to become a machine tool operator. Most semiskilled operators learn their jobs in a few months, but a skilled operator often requires 1-1/2 to 2 years. Some companies have formal training programs for new employees.

Although no special education is required for semiskilled jobs, young people seeking such work can improve their opportunities by completing courses in mathematics and blueprint reading. In hiring beginners, employers often look for people who have mechanical aptitude and some experience working with machinery. Physical stamina is important since much time will be spent standing. Applicants should be able to work independently within a relatively small work area. Although much of the work is tedious, many machine tool operators derive satisfaction from seeing the results of their work.

Skilled machine tool operators may become all-round machinists, tool and die makers, or advance to jobs in machine programing and maintenance.

Employment Outlook

The number of machine tool operators is expected to increase moderately through the mid-1980's, primarily as a result of the anticipated expansion of metalworking activities. In addition, many thousands of workers will be hired to replace experienced machine tool operators who retire, die, or transfer to other jobs.

Technological developments will continue to affect both the number and skill requirements of machine tool operators. The use of faster and more versatile automatic machine tools and numerically controlled machine tools will result in greater output per worker and tend to limit employment growth. Other factors that may slow the growth in this occupation are the increasingly important new processes in metal removal, such as electrical discharge and ultrasonic machining, and the use of powdered metals that reduce the machining necessary for a final product.

Workers who have thorough backgrounds in machining operations, mathematics, blueprint reading, and a good working knowledge of the properties of metals will be better able to adjust to the changing job requirements that will result from these technological advances.

Earnings and Working Conditions

Machine tool operators are paid according to hourly or incentive

rates, or on the basis of a combination of both methods. Average hourly rates for operators in 14 areas surveyed in 1972–73 are presented below:

Area	*Hourly rate*
Baltimore	$4.71
Boston	4.58
Chicago	5.46
Cincinnati	5.14
Denver	4.81
Detroit	6.06
Houston	4.32
Los Angeles–Long Beach	5.01
Minneapolis–St. Paul	4.85
Portland, Oreg.	4.87
San Francisco–Oakland	5.90
Tampa–St. Petersburg	3.75
Waterbury, Conn.	4.39
Worcester, Mass.	4.09

Machine tool operators must use protective glasses and may not wear loose-fitting garments when working around high-speed machine tools. Increasing emphasis upon safety regulations has reduced the accident rate for these workers. Most shops are clean and workplaces are well-lighted.

Companies employing machine tool operators usually provide paid holidays and vacations. Other employee benefits may include health and life insurance, accident insurance, supplemental unemployment benefits, and a pension plan.

Most machine tool operators belong to unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

Source of Additional Information

See the list under this same heading in the statement on all-round machinists.

SETUP MEN (MACHINE TOOLS)

(D.O.T. 600.380)

Nature of the Work

The setup man, often called a machine tool job setter, is a skilled specialist employed in plants and machine shops that do machining in large volume. His main job is to get machine tools ready for use (set up), and to explain to semiskilled workers the operations to be performed and ways to check the accuracy of their work. Usually a setup man is assigned a number of machine tools that often are of one type, such as turret lathes. However, he may set up several different kinds. Working from drawings, blueprints, written specifications, or job layouts, he determines the rate at which the material is to be fed into the machines, operating speeds, tooling, and operation sequence. He then selects and installs the proper cutting or other tools and adjusts guides, stops, and other controls. He may make trial runs and adjust the machine and tools until the parts produced conform to specifications. The machine is then turned over to a semiskilled operator.

Places of Employment

Most of the estimated 43,000 setup men in 1972 were employed in factories that manufactured fabricated metal products, transportation equipment, and machinery. These workers usually were employed by large companies that employed many semiskilled machine tool operators. They are not usually employed in maintenance shops or in small jobbing shops.

Training, Other Qualifications, and Advancement

A setup man must qualify as an all-round machinist. He must be able to operate one or more kinds of machine tools and select the sequence of operations so that metal parts will be made according to specifications. The ability to communicate clearly is important in explaining the machining operations to semiskilled workers. Setup men may be advanced within a shop or transferred into other jobs, such as parts programmer.

Employment Outlook

Employment of setup men is expected to increase rapidly through the mid-1980's as a result of the anti-

cipated expansion of metalworking activities due to heightened consumer and industrial demand for machined goods. Offsetting this somewhat will be increased productivity of setup men due to numerically-controlled machined tools. Job opportunities also will arise from the need to replace experienced setup men who retire, die, or transfer to other fields of work.

Earnings and Working Conditions

The earnings of setup men compare favorably with those of other skilled machining workers. In 1972, setup men generally earned between $4 and $6 an hour for a standard workweek.

Good safety habits are important since the setup man must handle sharp cutting tools. He also may be exposed to high-speed machine tools that have sharp cutting instruments when he makes the trial runs to test the accuracy of the setup.

Companies that employ setup men usually provide paid holidays and vacations. Many also provide paid accident, health and life insurance, and retirement.

Many setup men are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; and the United Steelworkers of America.

Sources of Additional Information

See list under this same heading in the statement on all-round machinists.

TOOL AND DIE MAKERS

(D.O.T. 601.280, .281, and .381)

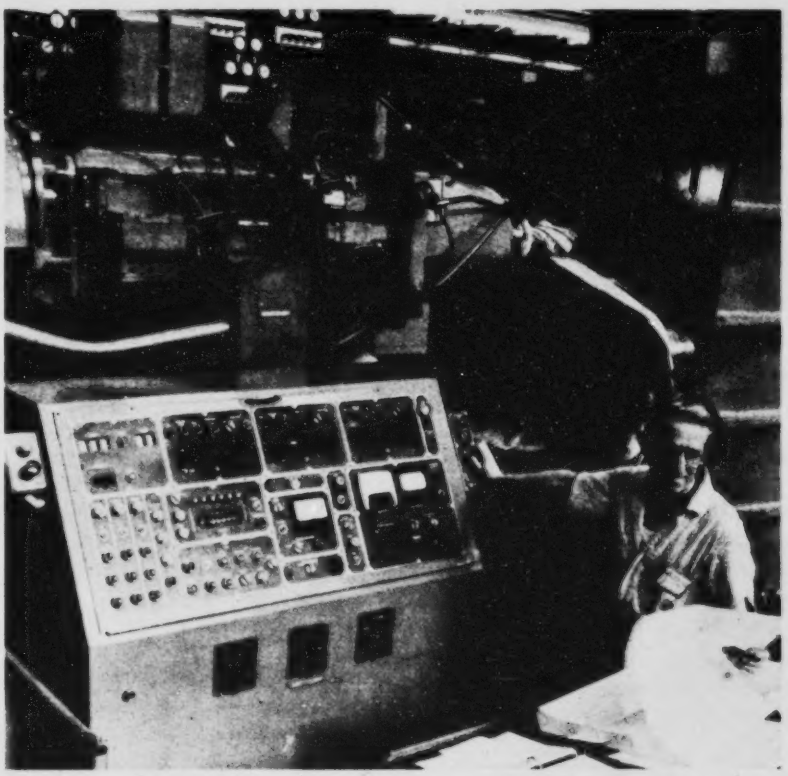
Nature of the Work

Tool and die makers are highly skilled, creative workers whose products—tools, dies, and special guiding and holding devices—are used to mass-produce metal parts. Toolmakers produce jigs and fixtures (devices that hold metal while it is shaved, stamped, or drilled). They also make gauges and other measuring devices for manufacturing precision metal parts. Diemakers construct metal forms (dies) to shape metal in stamping and forging operations. They also make metal molds for diecasting and for molding plastics. Tool and die makers repair worn or damaged dies, gauges, jigs, and fixtures, and design tools and dies.

Compared with most other machining workers, tool and die makers have a broad knowledge of machining operations, mathematics, and blueprint reading, and do precise handwork. Tool and die makers use almost every type of machine tool and precision-measuring instrument. They work and are familiar with the machining properties of metals and alloys commonly used in manufacturing.

Places of Employment

In 1972, about 170,000 tool and die makers were employed, primarily in plants that produce manufacturing, construction, and farm



Tool and Die maker uses computer run machine to make dies.

machinery. Others worked in automobile, aircraft, and other transportation equipment industries; small tool and die shops; and electrical machinery and fabricated metal industries.

Tool and die workers are found in every State. Large numbers were employed in California, Illinois, Michigan, New York, Ohio, and Pennsylvania.

Training, Other Qualifications, and Advancement

Tool and die making skills can be obtained through formal apprenticeship or equivalent on-the-job training. Applicants should have a good working knowledge of mathematics and physics, as well as considerable mechanical ability, finger dexterity, and an aptitude for precise work.

In selecting apprentices, most employers prefer young men who have a high school or trade school education. Some employers test apprentice applicants to determine their mechanical aptitudes and their abilities in mathematics. Young people entering the trade must be able to work to exacting standards in various types of tool and die work.

Most of the four years of a tool and die apprenticeship are spent in practical shop training. The apprentice learns to operate the drill press, milling machine, lathe, grinder, and other machine tools. He also learns, to use hand tools in fitting and assembling tools, gauges, and other mechanical equipment, and studies heat treating and other metalworking processes. Classroom training consists of shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading. Several years' experience after apprenticeship is often necessary to qualify for more difficult tool and die work. Some companies have separate appenticeship programs for toolmaking and diemaking.

Some machining workers become tool and die makers without completing formal apprenticeships. After years of experience as skilled machine tool operators or machinists, plus additional classroom training, they develop into all-round workers who can skillfully perform tool and die making.

Tool and die makers can become tool designers or advance to supervisory positions. Some open their own tool and die shops.

Employment Outlook

Employment of tool and die makers is expected to increase slowly through the mid-1980's. Most job opportunities will become available as experienced tool and die makers retire, die, or transfer to other fields of work.

The anticipated long-range expansion in the machinery, electrical equipment, transportation equipment, and other metalworking industries will result in a continued need for tools and dies. The growth of this occupation may be limited, however, by the use of electrical-discharge machines and numerically-controlled machines that have significantly changed toolmaking processes. Numerically-controlled machining operations require fewer of the special tools and jigs and fixtures that are made by tool and die makers. Numerically-controlled machines also could replace many of the conventional machines now used in manufacturing tools, jigs, and fixtures, and could increase the output of each tool and die maker.

As a group, tool and die makers have a long working life, because their extensive skills and knowledge can be acquired only after many years of experience. Tool and die makers also have greater occupational mobility than other less skilled workers, and can transfer to jobs as machinists.

Earnings and Working Conditions

Tool and die makers are among the highest-paid machining workers. Average hourly rates for tool and die makers in 15 areas surveyed in 1972–73 are presented below:

Area	*Hourly rate*
Atlanta	$5.44
Baltimore	5.40
Buffalo	5.74
Chattanooga	4.13
Chicago	6.03
Cincinnati	5.39
Dallas	5.00
Denver	5.38
Detroit	6.15
Houston	4.85
Los Angeles–Long Beach	5.37
New York	5.16
Salt Lake City	4.51
San Francisco–Oakland	6.66
Worcester, Mass.	4.21

As with other machining workers, tool and die makers wear protective glasses when working around metal cutting machines. Tool and die shops are usually safer than similar operations in production plants.

Most companies that employ tool and die makers pay for holidays and vacations. Health, life, and accident insurance and pensions are among other benefits.

Many tool and die makers are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; and the United Steelworkers of America.

Sources of Additional Information

See list under this same heading in the statement on all-round machinists.

PRINTING OCCUPATIONS

In 1972, more than 400,000 printing craftsmen were employed to produce newspapers, magazines, business forms, and hundreds of other printed materials. Although most of these craftsmen worked for publishers and commercial printing shops, many had jobs in insurance companies, paper mills, government agencies, and many other organizations that do their own printing.

Printing craftsmen usually specialize in one area of printing operations: type composition, platemaking, presswork, or binding. The most common way to learn the skills needed in most of these fields is through apprenticeship, which generally lasts from 4 to 6 years. Apprenticeship applicants usually must be high school graduates who are 18 to 30 years of age, but requirements vary among employers. Most printing craftsmen who are covered by union contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35 to 37-1/2 hour range.

Through the mid-1980's, opportunities to enter printing crafts will stem mainly from the need to replace experienced workers who retire, die, or leave the field for other reasons. Employment growth also will provide job openings in some crafts, but laborsaving technological developments will restrict growth in others.

The statements that follow deal with employment opportunities for the major groups of printing workers: composing room occupations, photoengravers, electrotypers and stereotypers, printing pressmen and assistants, lithographic occupations, and bookbinders.

BOOKBINDERS AND RELATED WORKERS

Nature of the Work

Many printed items, such as books and magazines must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled *bookbinders* (D.O.T. 977.781).

Edition-binding—making books in quantity from big, flat printed sheets of paper—is the most complicated kind of binding. Bookbinders first fold the printed sheets into one unit or more, known as a "signature," so that the pages will be in the right order. They then insert any illustrations that have been printed separately, gather and assemble signatures in proper order, and sew them together. They shape the book bodies with presses and trimming machines and reinforce them with glued fabric strips. Covers are glued or pasted onto the book bodies, and then the books undergo a variety of finishing operations and frequently are wrapped in paper jackets. Machines are used extensively throughout the process.

Skilled bookbinders seldom perform all the different binding tasks, but many have had training in all of them. In large shops, skilled bookbinders may be assigned to one or a few operations, most often to the operation of complicated machines, such as rounding and cutting machines.

Bookbinder finishes cover.

In many binding shops much of the work is done by bindery workers who are trained in only one operation or in a small number of relatively simple tasks. For example, bindery workers perform such tasks as fastening sheets or signatures together using a machine stapler and feeding signatures into various machines for stitching, folding, or gluing operations.

Places of Employment

About 33,000 bookbinders were employed in 1972. Many work in shops that specialize in bookbinding; others work in the bindery departments of book publishing firms, commercial printing plants, and large libraries. Some bookbinders work for the Federal government.

Training and Other Qualifications

A 4- or 5-year apprenticeship, which includes on-the-job training as well as related classroom instruction, generally is required to qualify as a skilled bookbinder. Apprenticeship applicants usually must have a high school education, mechanical aptitude, and be at least 18 years of age. During the apprenticeship, trainees learn to assemble signatures; to renovate old, worn bindings; and to use various binding machines, such as puncher and folders.

Most unskilled bindery hands learn their tasks through informal on-the-job training which may last from several months to 2 years. A few learn through formal apprenticeship programs that include classroom instruction as well as on-the-job training.

Employment Outlook

Employment of bookbinders and bindery workers is expected to increase moderately through the mid-1980's. In addition to the jobs from employment growth, several hundred openings will arise each year as experienced workers retire or change occupations.

Despite the anticipated growth in the amount of bound printed materials, employment growth will be limited by the increasing mechanization of bindery operations. For example, the use of integral folders which automatically fold pages as they come off the press.

Earnings and Working Conditions

Wage rates for skilled bookbinders tend to be below the average for other printing crafts. A survey of union wage rates in 69 large cities showed that the minimum wage rates for bookbinders in publishing firms and bookbinding shops averaged $5.86 an hour in 1972. This rate was about half again above the average for nonsupervisory workers in all private industries, except farming. Among the individual cities surveyed, minimum hourly rates for bookbinders ranged from $3.06 in Syracuse, N.Y. to $7.88 in New York, N.Y.

The wage rates for bindery workers are considerably lower than the rates for bookbinders, and are among the lowest for printing industry workers. A survey of union wages in 69 large cities shows that in 1972 the average minimum hourly rate for bindery workers was $3.54. Among the individual cities surveyed, minimum hourly rates for bindery workers ranged from $3.06 in Syracuse, N.Y., to $4.25 in New York, N.Y.

Bookbinding shops tend to be noisy when machinery is operating. Bookbinders have some variety in their jobs, but the jobs of bindery workers tend to be monotonous.

Most bindery workers are members of the Graphic Arts Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local bookbinding shops, local offices of the Graphic Arts Union, or the local office of the State employment service.

General information on bookbinding occupations is available from the following organizations:

American Newspaper Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

The Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

The Graphic Arts Union, 1900 L St. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22201.

COMPOSING ROOM OCCUPATIONS

(D.O.T. 650.582, 654.782, and 973.381)

Nature of the Work

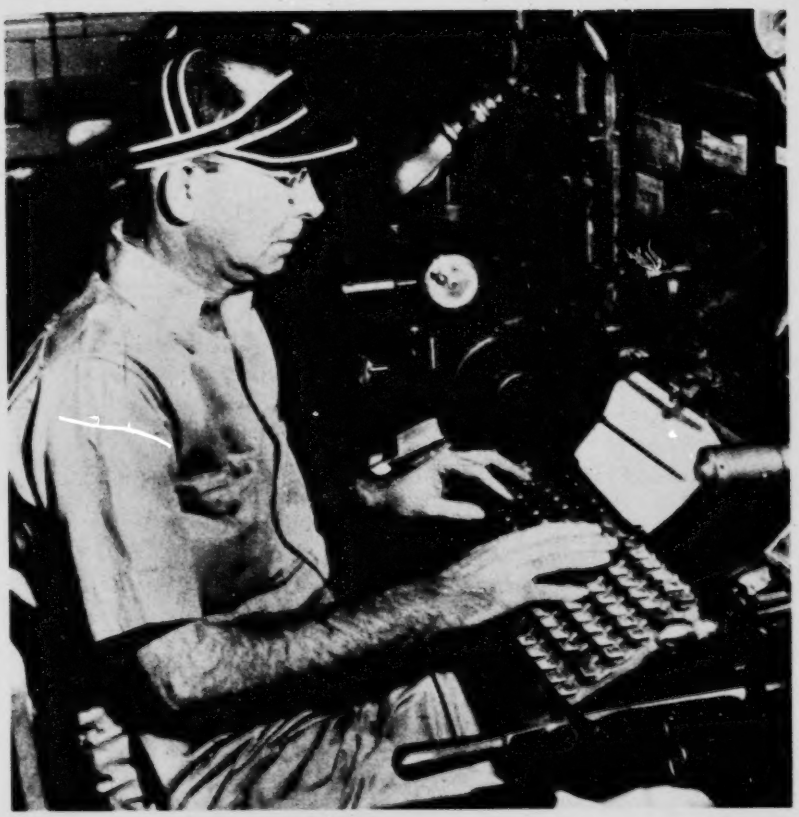
The printing process begins in a composing room when manuscript copy is set in type, proofed, and checked for errors. Machine and handset type and other materials such as photoengravings are assembled and prepared for the pressroom.

Hand compositors (typesetters) (D.O.T. 973.381) make up the oldest composing-room occupation. Today most type that is set by hand is for work that requires special composition (usually larger size type for advertising copy) and for small jobs in which the setting of type by machine would be impractical.

To set type, the compositor reads from the manuscript copy and sets each line of type in a "composing stick" (a device that holds type in place) letter by letter and line by line. When this stick is full, the compositor slides the completed lines onto a shallow metal tray called a "galley."

Typesetting machine operators are craftsmen who operate semiautomatic machines which set type much more rapidly than hand methods. Many of these workers specialize in operating linotype, keyboard, casting, or phototypesetting machines.

Linotype (or intertype) machine operators (D.O.T. 650.582), reading from the copy clipped to the machine's copy board, select letters and other characters by operating a keyboard which has 90 keys. As they press the keys, the letters, in forms of metal molds, are assembled into lines of words. As they complete each line, the operators touch a lever and the machine automatically casts the line of type into a solid metal strip called a "slug." The slugs are assembled



Linotype operator sets type.

into the type forms from which either the printing impressions or printing plates are made. Nearly all newspaper plants, large commercial shops, and typographic composition firms use these machines to set type. In small plants, operators also may maintain and repair typesetting machines.

Monotype keyboard operators (D.O.T. 650.582) operate keyboards which are similar to typewriters, but which have about four times as many keys. The keyboard machine produces a perforated paper tape that later is fed into the casting machine by *monotype caster operators* (D.O.T. 654.782). The machine reads the tape and automatically selects the metal molds for each letter. Molten metal is forced into molds to form the type. Caster operators insert the tape, adjust and tend the machine while it is operating, and do minor maintenance and repair work.

Phototypesetting machine operators (D.O.T. 650.582) operate high speed typesetting machines. In phototypesetting, a photographic process replaces the function of the hot metal, and the final product is a film or photographic print of the type rather than a metal slug. In a common kind of phototypesetting, perforated paper tape or a magnetic tape is fed into a machine which reads the tape and photographs the individual characters indicated on the tape.

In addition to machine operation, phototypesetters must be familiar with the fundamentals of photography, including darkroom procedures, to develop the film. They also make minor repairs on the phototypesetting machine. Since much of this equipment has electronic controls, operators need a basic knowledge of the principles of electronics.

Typesetting machine operators also use machines similar to typewriters to set "cold type" on paper. "Cold type" composition may be set directly on a paper or metal sheet from which the plate is to be made, or the cold type images may be cut from paper and pasted on layout sheets. The process of assembling and pasting this type on layout sheets is called paste makeup, and is somewhat similar to hand composition. The worker who assembles and pastes up all the materials for a page is called a *paste-makeup man.* Cold type composition frequently is used by newspapers for display advertising, and to set regular text copy.

Places of Employment

About 170,000 workers were employed in composing room occupations in 1972. About one-third work for newspaper plants. Many others work for commercial printing plants, book and magazine printers, and Federal, State, and local governments. Some work for banks, insurance companies, advertising agencies, manufacturers, and other firms that do their own printing.

Composing room workers can find jobs in almost every community throughout the country, but they are concentrated in large cities.

Training and Other Qualifications

Most compositors obtain their skills through apprenticeship training. Others learn while working as shop helpers for several years, or through a combination of trade

school and helper experience.

Generally, apprenticeship covers a 6-year period of progressively advanced training, supplemented by classroom instruction or correspondence courses. However, this period may be shortened by as much as 2 to 2-1/2 years for apprentices who have had previous experience or schooling or who show the ability to learn the trade more rapidly.

After basic training as a hand compositor, the apprentice receives intensive training in one specialized field or more, such as in the operation of typesetting machines, including phototypesetting and teletypesetting machines, as well as in specialized work in hand composition and photocomposition.

Applicants for apprenticeship generally must be high school graduates and in good physical condition. They sometimes are given aptitude tests. Important qualifications include training in English, especially spelling, and in mathematics. Printing and typing courses in vocational or high schools are good preparation for apprenticeship applicants, and a general interest in electronics and photography is becoming increasingly useful. Artistic ability is an asset for a compositor in layout work.

Tape-perforating machine operators must be expert typists. They generally learn to type in commercial courses in high school or in business school. These operators do not need to be trained as journeymen compositors but they must be familiar with printing terms and measurements. The training period for tape-perforating machine operators is about a year.

Employment Outlook

Employment in composing-room occupations is expected to decline slowly through the mid-1980's. Nevertheless, a few thousand job openings are expected each year as experienced workers retire, die, or change occupations.

In spite of the anticipated expansion in the volume of printing, employment in composing room occupations is expected to decline because of technological changes in typesetting equipment that will enable fewer operators to set type faster. For example, over the past decade automatically operated typesetting machines have been used increasingly. The use of computers, programmed to perforate the codes for spacing, length of line, and hyphenation, simplifies the work of the tape-perforating machine operator and increases the speed at which type can be set.

Technological changes also will affect the educational and skill requirements for composing room workers. For example, greater use of phototypesetting requires workers who have some photographic skills. Since much of the new typesetting equipment is operated by electronics systems, a knowledge of the principles of electronics is becoming increasingly important for composing room workers.

Earnings and Working Conditions

Union compositors on the day shift in newspaper plants had an average minimum rate of $5.94 an hour in 1972, according to a survey of 69 large cities. This rate was about one-half more than the average for nonsupervisory workers in all private industries, except farming. Minimum hourly rates for compositors among the surveyed cities ranged from $3.55 in Tampa, Fla., to $6.86 in Chicago, Ill. Compositors who worked nights received slightly higher pay.

Working conditions for compositors vary from plant to plant. Some heat and noise are made by typesetting machines. In general, the new plants are well-lighted and clean, and many are air-conditioned. Hand compositors have to stand for long periods and do some heavy lifting. People with some types of physical handicaps, such as deafness, have been able to work in the trade.

A substantial proportion of compositors are members of the International Typographical Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers, such as newspapers and printing shops, the local office of the International Typographical Union, or the local office of the State employment service.

General information on composing room occupations is available from the following organizations:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

International Typographic Composition Association, Inc., 2233 Wisconsin Ave. NW., Washington, D.C. 20007.

International Typographical Union, P.O. Box 157, Colorado Springs, Colo. 80901.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22201.

ELECTROTYPERS AND STEREOTYPERS

Nature of the Work

Electrotypers (D.O.T. 974.381) and *stereotypers* (D.O.T. 975.782)

make duplicate press plates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly for newspapers. Electrotyping and stereotyping are necessary because most volume printing requires the use of duplicate plates. When a large edition of a magazine or newspaper is printed, several plates must be used to replace those which become too worn to make clear impressions. Furthermore, many big plants use rotary presses which require curved plates made by either electrotyping or stereotyping from flat type forms.

Electrotypers make a wax or plastic mold of the metal type form which is coated with chemical solutions before being placed in an electrolytic bath containing metal. This leaves a metallic shell on the coated mold. The shell is stripped from the mold, backed with metal or plastic, and carefully finished.

The stereotyping process is simpler, quicker, and less expensive than electrotyping, but it does not yield as durable or as fine a plate. Stereotypers make molds or mats of papermache instead of wax or plastic. The mat is placed on the type form and covered with a cork blanket and a sheet of fiberboard. The covered form is run under heavy steel rollers to impress the type and photoengravings on the mat. Then the mat is placed in a stereotype casting machine which casts a composition lead plate on the mold. In many of the larger plants, automatic machines cast stereotype plates.

Some electrotypers and stereotypers do only one phase of the work, such as casting, molding, or finishing. Others handle many tasks.

Places of Employment

About 4,000 electrotypers and stereotypers were employed in 1972. Many electrotypers work in large plants that print books and magazines. Most stereotypers work for newspaper plants, but some are employed in large commercial printing plants. Electrotypers and stereotypers also are employed in service shops which do this work for printing firms.

Jobs in these trades can be found throughout the country, but employment is concentrated in large cities.

Training and Other Qualifications

Nearly all electrotypers and stereotypers learn their trades through 5- to 6-year apprenticeships. Electrotyping and stereotyping are separate crafts and relatively few transfers take place between the two. The apprenticeship program of each trade covers all phases of the work and almost always includes classes in related technical subjects as well as training on the job.

Apprenticeship applicants must be at least 18 years of age and, in most instances, must have a high school education or its equivalent. If possible, this education should include courses in chemistry and machine shop. Physical examinations and aptitude tests often are given to prospective apprentices.

Employment Outlook

Employment of electrotypers and stereotypers is expected to decline slowly through the mid-1980's. Nevertheless, a small number of openings will arise as experienced workers retire, die, or change occupations.

Despite the anticipated increase in the total volume of printing, employment will decline because of labor-saving technological developments. For example, the increasing use of automatic plate-casting eliminates many steps in platemaking. Furthermore, the greater use of lithographic (offset) printing reduces the need for electrotype and stereotype plates, which are not needed in lithographic printing.

Earnings and Working Conditions

In 1972 union minimum wage rates in 69 large cities averaged $5.58 an hour for electrotypers and $5.83 an hour for stereotypers in book and commercial printing shops. Both averages were considerably higher than the average for nonsupervisory workers in all private industries, except farming.

Much of the work in these trades requires little physical effort since the preparation of duplicate printing plates is highly mechanized. However, some lifting of relatively heavy press plates is required.

Nearly all electrotypers and stereotypers are members of the International Stereotypers' and Electrotypers' Union of North America.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers, such as newspapers and printing shops, the local office of the International Stereotypers' and Electrotypers' Union, or the local office of the State employment service.

General information on electrotypers and stereotypers is available from the following organizations:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

International Stereotypers' and Electrotypers' Union of North America, 10 South La Salle St., Chicago, Ill. 60603.

Printing Industries of America, 1730 North Lynn St., Arlington, Va. 22201.

LITHOGRAPHIC OCCUPATIONS

Nature of the Work

Lithography, also called offset printing, is one of the most rapidly growing methods of printing. It is a process of photographing the matter to be printed, making a printing plate from the photograph, and pressing the inked plate against a rubber plate which in turn presses it onto the paper.

Several operations are involved in lithography, and each is performed by a specialized group of workers. The main group of lithographic workers includes cameramen, artists, and letterers, strippers, platemakers, and pressmen.

Cameramen (D.O.T. 972.382) start the process of making a lithographic plate by photographing and developing negatives of the copy. They generally are classified as line cameramen, halftone cameramen, or color separation photographers. Negatives may need retouching to lighten or darken certain parts. *Lithographic artists* (D.O.T. 972.281) make these corrections by sharpening or reshaping images on the negatives. They do the work by hand, using chemicals, dyes, and special tools. Like cameramen, they are assigned to only one phase of the work, and may have job titles such as dot etchers, retouchers, or letterers.

Strippers (D.O.T. 971.281) arrange and paste film or prints of type and art work on the layout sheets from which photographic impressions are made for the press plates. *Platemakers* (D.O.T. 972.781) cover the surface of the plates with a coating of photosensitive chemicals, or the plate may come with the coating already applied. After exposing the sensitized plate to the negative, they chemically treat the plate to bring out the photographic image.

Lithographic pressmen (D.O.T. 651.782) tend lithographic (offset) printing presses. They install plates on the presses and adjust the pressure and water and ink rollers for correct operation. Basically, the duties of these workers are similar to those of letterpress and gravure pressmen.

Places of Employment

About 80,000 skilled lithographic workers were employed in 1972. Many work for commercial printing plants, newspapers, and book and magazine printers. Some work for the U.S. Government Printing Office.

Lithographic workers can find jobs throughout the country, but most jobs are in large cities.

Training and Other Qualifications

A 4- or 5-year apprenticeship program usually is required in order to become a well-rounded lithographic craftsman. These programs may emphasize a specific craft, such as platemaker or pressman, although an attempt is made to make the ap-

prentice familiar with all lithographic operations.

Usually, apprenticeship applicants must be in good physical condition, high school graduates, and at least 18 years of age. Aptitude tests are sometimes given to prospective apprentices. High school and vocational school training in photography, mathematics, chemistry, physics, and art are helpful in learning these crafts.

Employment Outlook

Employment of skilled lithographic workers is expected to increase very rapidly through the mid-1980's. In addition to the job openings resulting from employment growth, the need to replace workers who retire, die, or change occupations will provide some openings.

Employment of lithographic workers is expected to increase in response to the continued growth of offset printing. Commercial printing firms and newspaper publishers increasingly are using offset presses in place of letter presses. Employment growth also will be stimulated by the greater use of photographs and drawings in printed matter, and by the more widespread use of color in many printed products.

Earnings and Working Conditions

Average minimum union rates for cameramen, dot etchers or process artists, and letterers ranged from $4.00 an hour in Little Rock, Ark., to $7.46 an hour in Boston, Mass., according to a survey in 69 large cities in 1972. Rates of platemakers ranged from $4.00 an hour in Little Rock, Ark., to $7.15 an hour in Boston, Mass. The wide range of rates for lithographic pressmen—from $3.21 an hour for small multilith press operators in Little Rock, to $9.51 an hour for a pressman on a large web press in Chicago—is due largely to the many different types and sizes of presses.

Lithographic workers are on their feet much of the time, but the work is not strenuous. They are sometimes under pressure to meet publication deadlines.

Most lithographic workers are members of the Graphic Arts International Union. A large number of offset pressmen are members of the International Printing Pressmen and Assistants' Union of North America.

Sources of Additional Information

Details on apprenticeship and other training opportunities in lithographic occupations are available from local employers, such as newspapers and printing shops, local offices of the union previously mentioned, or the local office of the State employment service. General information on lithographic occupations may be obtained from:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

The Graphic Arts International Union, 1900 L St. NW., Washington, D.C. 20036.

International Printing Pressmen and Assistants' Union of North America, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

National Association of Photo-Lithographers, 230 West 41st St., New York, N.Y. 10036.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22201.

PHOTOENGRAVERS

(D.O.T. 971.281 and .382)

Nature of the Work

Photoengravers make metal printing plates of pictures and other copy that cannot be set up in type. In letterpress photoengraving, ink is rolled over the printed surface which stands higher than the rest of the plate. When paper is pressed against the raised surface, the print or image is picked up. Similarly, gravure photoengravers make gravure plates on which the image is etched below the plate's surface. Ink is placed in the etched or sunken areas, and when paper is pressed against the surface the ink is lifted out and appears on the paper.

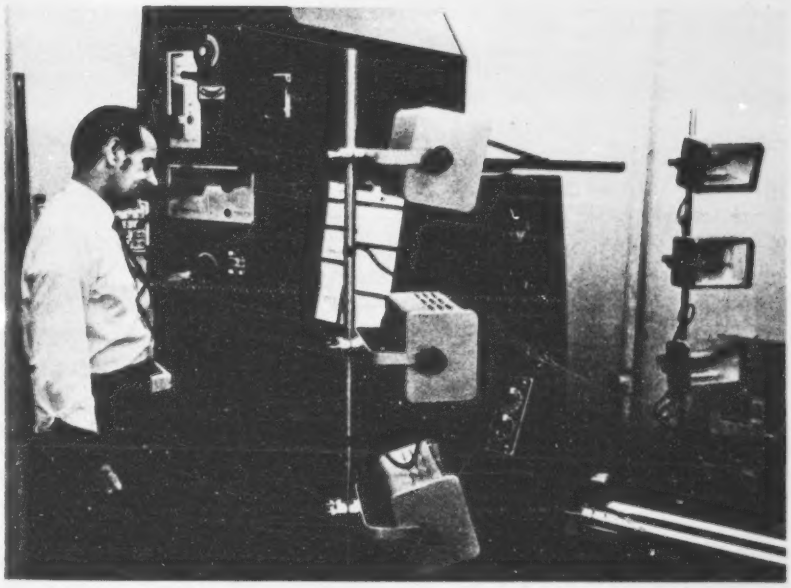
In the making of a photoengraving plate for the letterpress process, the entire job may be done either by one worker or by several, each doing a particular operation, such as camera work, printing, and etching. In large shops, however, the work is divided almost always among a number of these specialists.

Photoengravers first photograph the material to be reproduced. After developing the negative, they print the image on a metal plate by coating the plate with a solution sensitive to light and then exposing it to the negative. When the plate is placed in an acid bath, the nonimage areas are etched away and the image areas stand out.

The number of photoengraving operations performed depends on the quality of the printing required. Photoengravings for very high quality books or periodicals, for example, require more careful finishing than those for newspapers. Photoengravers use handtools to inspect and touch up the plates. They cut away metal from the nonprinting part of the plate to prevent it from

touching the inking rollers during printing.

Gravure photoengraving is like letterpress photoengraving, except that in gravure photoengraving the image areas rather than the background are etched away.



Places of Employment

An estimated 16,000 journeymen photoengravers were employed in 1972. More than half work in commercial shops making photoengravings for other printing firms. Newspapers and rotogravure shops employ several thousand photoengravers. Book and magazine printers and the Federal government also employ these craftsmen. Many photoengravers have their own shops.

Photoengravers can find jobs throughout the country, but employment is concentrated in large printing centers, such as New York, Chicago, Philadelphia, and Los Angeles.

Training and Other Qualifications

Most photoengravers learn their trade through a 5-year apprenticeship program which includes at least 800 hours of classroom instruction. Apprenticeship applicants must be at least 18 years of age and generally must have a high school education or its equivalent, preferably with courses in chemistry and physics. Many employers require a physical examination for prospective photoengravers; the condition of the applicant's eyes is particularly important because of the close work and color discrimination involved.

Employment Outlook

Employment of photoengravers is expected to decline slowly through the mid-1980's. However, a few hundred job openings are expected each year as experienced workers retire, die, or change occupations.

Employment of these craftsmen is expected to decline despite the growing use of photographs and other illustrations in publications. Improved photographic equipment, and the increasing use of lithographic (offset) printing, which requires no photoengraving, will limit the number of photoengravers needed.

Earnings and Work Conditions

Union photoengravers on the day shift in newspaper plants had an average minimum rate of $6.46 an hour in 1972, according to a survey of 69 large cities. This average was about two-thirds more than the average for nonsupervisory workers in all private industries, except farming. Minimum hourly rates for photoengravers among the surveyed cities ranged from $4.31 in Jacksonville, Fla. to $8.01 in New York, N.Y.

Photoengravers stand up much of the time, but the work is not strenuous. Work areas usually are air-conditioned and well-lighted. Most photoengravers are members of the Graphic Arts International Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers, such as newspapers and printing shops, the local office of the Graphic Arts Union, or the local office of the State employment service.

General information on photoengravers is available from the following organizations:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

American Photoplatemakers Association, 166 West Van Buren St., Chicago, Ill. 60604.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

The Graphic Arts Union, 1900 L St. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22201.

PRINTING PRESSMEN AND ASSISTANTS

(D.O.T. 651.782, .885, and .886)

Nature of the Work

The actual printing operation is performed in the pressroom. Printing pressmen prepare type forms and press plates for final printing and tend the presses.

The object of preparation work is to insure printing impressions that are distinct and uniform. This operation may be performed by placing pieces of paper exactly the right thickness underneath low areas of the press plates to level them. Pressmen also adjust control margins and the flow of ink to the inking roller. In some shops, they oil and clean the presses and make minor repairs. Pressmen who work with large presses have assistants and helpers.

Pressmen's work may differ greatly from one shop to another, mainly because of differences in the kinds and sizes of presses. Small commercial shops generally have small and relatively simple manual presses. At the other extreme are the enormous presses used by the large newspaper, magazine, and book printers. These giant presses are fed paper in big rolls called "webs" up to 50 inches or more in width. They print the paper on both sides; cut, assemble, and fold the pages; and count the finished newspaper sections as they come off the press. Presses of this kind are operated by crews of journeymen and less skilled workers under the direction of a *pressman-in-charge.*

Places of Employment

About 140,000 pressmen and assistants were employed in 1972. More than half work for commercial printing shops and book and magazine publishers. Many others have jobs in newspapers plants. Some pressmen and assistants are employed by banks, insurance companies, manufacturers, and other organizations that do their own printing, such as Federal, State, and local governments.

Pressmen and assistants can find jobs throughout the country, but employment is concentrated in large cities.

Training and Other Qualifications

Most pressmen learn their trade through apprenticeship, but some workers learn while working as helpers or press assistant. Others obtain their skills through a combination of work experience and vocational or technical school training.

The length of apprenticeship and the content of training depend largely on the kind of press used in the plant. The apprenticeship period in commercial shops is 2 years for press assistants, and 4 to 5 years for pressmen. In addition to on-the-job instruction, the apprenticeship includes related classroom or correspondence school courses.

Individual companies generally choose apprentices from among press assistants and others already employed in the plant. Young people often may work for 2 or 3 years in the pressroom before they begin apprenticeship training. A high school education or its equivalent generally is required. Because of technical developments in the printing industry, courses in chemistry and physics are helpful. Mechanical aptitude is important in making press adjustments and repairs. An ability to visualize color is essential for work on color presses, which are being used increasingly. Physical strength and endurance are needed for work on some kinds of presses, where the pressmen lift heavy plates and stand for long periods.

Employment Outlook

Employment of pressmen is expected to increase slowly through the mid-1980's. In addition to the jobs from employment growth, a few thousand openings will arise each year as experienced workers retire, die, or change occupations.

More pressmen will be needed because of growth in the amount of printed materials. The use of faster and more efficient presses, many of which have automatic controls, will limit employment growth.

Earnings and Working Conditions

A survey of union wages in 69 large cities shows that in 1972 the average minimum hourly rate for newspaper pressmen-in-charge was $6.06; for newspaper pressmen, $5.80; for book and job cylinder pressmen, $5.92; and for book and job press assistants and feeders, $5.29. These rates were higher than the average for all nonsupervisory workers in private industries, except farming. Many pressmen work night shifts and receive extra pay.

Pressrooms are noisy, and workers in certain areas frequently wear ear protectors. Pressmen are subject to hazards when working near machinery, and often have to lift heavy type forms and press plates. At times, they work under pressure to meet deadlines.

Most pressroom workers are covered by union agreements. The principle union in this field is the International Printing Pressmen and Assistants' Union of North America.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers, such as newspapers and printing shops,

the local office of the International Printing Pressmen and Assistants' Union, or the local office of the State employment service.

General information about pressmen and assistants is available from the following organizations:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

International Printing Pressmen and Assistants' Union of North America, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22201.

OTHER INDUSTRIAL PRODUCTION AND RELATED OCCUPATIONS

ASSEMBLERS

Nature of the Work

Television sets, automobiles, and refrigerators are typical of the manufactured products that undergo many assembly operations. Assemblers, most of whom are semiskilled workers, put together the parts for these and thousands of other products.

Some assemblers, known as floor assemblers, put together large, heavy machinery or equipment on shop floors, often fastening parts with bolts, screws, or rivets. Others, known as bench assemblers, put together small parts to make subassemblies or small complete units. Many assemblers work on items that move automatically past their work stations on conveyors. These workers must complete their job within the time it takes the part or product to pass their work station.

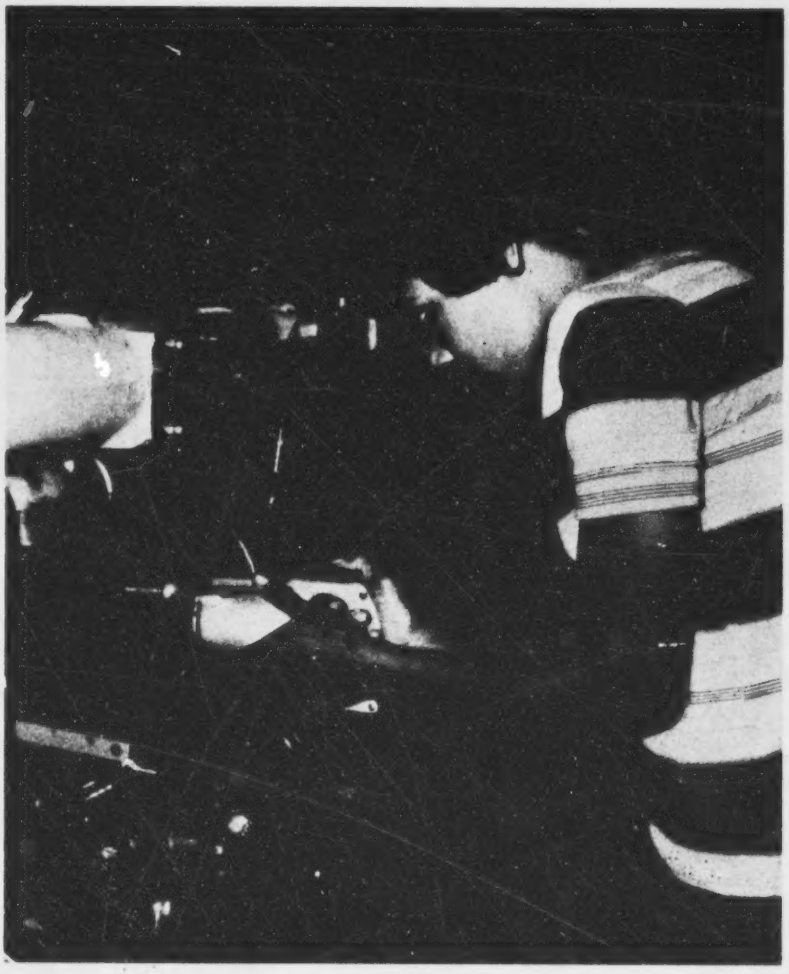
The duties of assemblers depend upon the product being manufactured and the process being used. In aircraft and missile production, these workers may assemble and install parts into subassemblies. In the automobile industry, one assembler may start nuts on bolts, and the next worker may tighten the nuts with power-driven tools. Assemblers in electronic plants may connect parts with electrical wire.

Assemblers use many different tools depending on the product and the work they are doing. Pliers, screwdrivers, soldering irons, power drills, and wrenches are among the common tools used by semiskilled assemblers.

Skilled assemblers work on the more complex parts of subassemblies with little or no supervision, and are responsible for the final assembly of complicated jobs. These workers must know how to read blueprints and other engineering specifications and use a variety of tools and precision measuring instruments. In relatively new fields such as electronics, instrumentation, and missiles, subassembly work may require a high degree of skill.

Places of Employment

In 1972, more than 1 million assemblers—half of them women—worked in manufacturing plants. Most were in plants that made fabricated metal products, machinery, and motor vehicles. More than half of all assemblers were



employed in the heavily industrialized States of California, New York, Michigan, Illinois, Ohio, New Jersey, and Pennsylvania.

Training, Other Qualifications, and Advancement

Inexperienced people can be trained to do assembly work in a few days or weeks. The new worker may have his job duties explained to him by the supervisor and then be placed under the direction of an experienced employee. When the new worker has developed sufficient speed and skill, he is placed "on his own" and is responsible for the work he does.

Employers seek applicants who are physically fit and dependable and who have some aptitude for mechanical work. High school graduates or workers who have taken vocational school courses, such as blueprint reading, are preferred by many employers, although a high school diploma is not usually required. Generally, for production-line jobs, employers look for applicants who can do routine work at a fast pace. For other types of assembly jobs, applicants may have to meet special requirements. For example, in plants that make electrical and electronic products, which may contain many different colored wires, applicants often are tested for color blindness.

A relatively small number of semiskilled assemblers advance to skilled assembly jobs. A few also may become inspectors or foremen.

Employment Outlook

Employment of assemblers is expected to increase slowly through the mid-1980's, with thousands of openings each year. Many more job openings will result as workers retire, die, or transfer to other occupations.

Manufacturing plants will need more assemblers to produce goods for the Nation's growing economy. Growth in population and personal income will increase the demand for consumer products such as automobiles and household appliances. Business expansion will increase the demand for industrial machinery and equipment. Employment of assemblers, however, is not expected to keep pace with manufacturing output because automation of assembly processes and other laborsaving innovations are expected to raise output per worker and limit employment growth.

Employment in plants that produce durable goods, such as automobiles and aircraft, is particularly sensitive to changes in business conditions and national defense needs. Therefore, assemblers in these plants may be subject to occasional layoffs.

Earnings and Working Conditions

Wage rates for assemblers ranged from about $3 to $5 an hour in 1972, according to information from a limited number of union contracts. Variation in wages depends on geographic area, industry, and type of assembly work.

The working conditions of assemblers differ, depending on the particular job performed. Assemblers of electronic equipment may put together small components at a bench in a room that is clean, well lighted, and free from dust. Floor assemblers of industrial machinery, on the other hand, may install and assemble heavy parts and may often be exposed to contact with oil and grease. Workers on assembly lines may be under pressure to keep up with the speed of the lines. Some assemblers are paid incentive or piece-work rates and are encouraged to work more rapidly by the prospect of higher earnings.

Many assemblers are members of labor unions. These include the International Association of Machinists and Aerospece Workers; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers. Most union contracts provide for fringe benefits such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

Source of Additional Information

Additional information about employment opportunities for assemblers may be available from local offices of the State employment service.

AUTOMOBILE PAINTERS

(D.O.T. 845.781)

Nature of the Work

Automobile painters make old and damaged motor vehicles "look like new." These skilled workers repaint vehicles that have lost the luster of their original paint, and the repaired portions of vehicles damaged in traffic accidents. (Production painters who work for motor vehicle manufacturers are discussed elsewhere in the *Handbook*.)

To prepare an automobile for painting, painters or their helpers rough-sand it to remove original paint and rust. Painters then use a spray gun to apply primer coats to the automobile surface. After the primer dries, they sand the surface

until it is smooth. For rough-sanding, they usually use a pneumatic or electric sander and a coarse grade of sandpaper; final sanding may be done by hand, using a fine grade of sandpaper. Small nicks and scratches that cannot be removed by sanding are filled with automobile-body putty. Masking tape and paper are used to cover areas not to be painted.

Before painting repaired portions of an automobile, painters may mix paints to match the color of the car. Before applying paint, they adjust the nozzle of the spray gun according to the kind of lacquer or enamel being used and, if necessary, adjust the air-pressure regulator to get the needed amount of pressure. Painters must handle the spray gun skillfully so that the paint is applied evenly, rapidly, and thoroughly. To speed drying, they may place the freshly painted automobile under heat lamps or in a special infrared oven. Painters or their helpers may polish the newly painted surface.

Places of Employment

About 25,000 persons worked as automobile painters in 1972. Almost two-thirds worked in shops that specialize in automobile body repairs and painting, and in shops that make general automobile repairs. Most others worked for automobile and truck dealers. Some painters worked for organizations that maintained and repaired their own fleets of motor vehicles, such as trucking companies and bus lines.

Geographically, employment is distributed about the same as population, although automobile painters are employed in every section of the country.

Training, Other Qualifications, and Advancement

Most automobile painters start as helpers, and acquire their skills informally by working with experienced painters. Usually, beginners remove automobile trim, clean, and sand surfaces to be painted, and polish painted surfaces. As helpers gain experience, they progress to more complicated tasks, such as using spray guns to apply primer coats and paint small areas. Three to four years of informal on-the-job training are required in order to become fully qualified.

A small number of automobile painters learn through apprenticeship. Apprenticeship programs, which generally last 3 years, consist of on-the-job training supplemented by classroom instruction.

In 1972, training programs for unemployed and underemployed workers seeking entry jobs as automobile painters were in operation in several cities, under the Manpower Development and Training Act. Persons who complete these programs, which usually last up to a year, generally need additional on-the-job or apprenticeship training to qualify as skilled painters.

Young persons considering this work as a career should have good health, keen eyesight, a good color sense, and a steady hand. Courses in automobile-body repair offered by high schools and vocational schools provide helpful experience. Completion of high school is generally not a requirement but may be an advantage, because to many employers high school graduation indicates that a young person can complete a job.

An experienced automobile painter with supervisory ability may advance to shop foreman. Many experienced painters who acquire the necessary capital open their own shops.

Employment Outlook

Employment of automobile painters is expected to increase moderately through the mid-1980's. In addition to jobs created by growth, several hundred openings are expected each year because of the need to replace experienced painters who retire or die. Openings also will occur as some painters transfer to other occupations.

Employment of automobile painters is expected to increase primarily because more motor vehicles will be damaged in traffic accidents as the number of vehicles grows. Accident losses will grow, even though better highways, driver training courses, and improved bumpers and other safety features on new vehicles may slow the rate of growth. Despite the increasingly durable paint on new cars, the number of cars that need repainting also may increase.

Earnings and Working Conditions

Painters employed by automobile dealers in 34 large cities had estimated average hourly earnings of $3.66 in 1972, compared with $3.65, the average for all nonsupervisory workers in private industry, except farming. Skilled painters usually earn between two and three times as much as inexperienced helpers and trainees.

Many painters employed by automobile dealers and independent repair shops are paid a commission based on the labor cost charged to the customer. Under this method, earnings depend largely on the amount of work and how fast the painter completes it. Employers frequently guarantee their commissioned painters a minimum weekly salary. Helpers and trainees usually are paid an hourly rate until they are sufficiently skilled to work on a commission basis. Painters employed by trucking companies, buslines, and other organizations that repair their own vehicles usually receive an hourly rate. Most painters work 40 to 48 hours a week.

Many employers provide holiday and vacation pay, and additional benefits such as life and health insurance, and contribute to retirement plans. Some shops furnish laundered uniforms free of charge.

Automobile painters are exposed to fumes from paint and paint-mixing ingredients. However, in most shops, the painting is done in special ventilated booths that protect the painters. Masks covering the nose and mouth are used, as well. Painters must be agile because they often bend and stoop while working. Only average physical strength is needed.

Many automobile painters belong to unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most painters who are union members work for the larger automobile dealers, trucking companies, and buslines.

Sources of Additional Information

For more details about work opportunities, contact local employers, such as automobile-body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile painters may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils of America, Inc., 4001 Warren Blvd., Hillside, Ill. 60162.

AUTOMOBILE TRIMMERS AND INSTALLATION MEN (AUTOMOBILE UPHOLSTERERS)

(D.O.T. 780.381 and .884)

Nature of the Work

Automobile trimmers, often assisted by installation men, replace and repair upholstery and other automobile fabrics. Trimmers and installation men together are called automobile upholsterers. (Workers who upholster automobiles in factories are not included in this statement.)

Automobile trimmers (D.O.T. 780.381) are skilled upholsterers who custom-make seat covers, door panels, convertible tops, and other items. To make these items, they first determine the dimensions of each peice of vinyl, leatherette, broadcloth, or other material to be used and mark the material for cutting. Although trimmers follow standard designs for most items, they may use their own creations or the original designs specified by customers. After cutting and fitting, they use heavy-duty sewing machines to stitch the pieces. Finished pieces are stretched and pulled to fit snugly; and then trimmed of excess material. In addition to upholstery and convertible tops, trimmers may make truck seat

cushions, tarpaulins, boat covers, and seats for buses, motorcycles, and small airplanes. They also may mend damaged upholstery, repair window and convertible top mechanisms, and cut and install automobile glass.

Automobile trimmers often are assisted by installation men, sometimes called *seat-cover installers* (D.O.T. 780.884), who remove worn seat covers and convertible tops and install new ones. In addition they may install sunroofs and vinyl tops.

Trimmers and installation men use many handtools including shears, knives, special pliers, and various types of wrenches and tack hammers. They also use heavy-duty sewing machines and power tools such as air-powered staplers and wrenches. Some shops have electric steaming machines which shrink fabrics, and special electronic welders which bind synthetic materials.

Places of Employment

Most of the 9,000 automobile trimmers and installation men employed in 1972 worked in shops that specialized in automobile upholstery and convertible tops. Others worked in automotive repair and accessories sections of department stores, and in automobile dealerships and body repair shops. Most automobile upholstery shops employ from one to five trimmers. In small shops, the number of installation men generally equals the number of trimmers. However, installation men outnumber trimmers in many of the larger shops, particularly those that specialize in installing factory-made seat covers and tops.

Automobile upholsterer installs new seat covers.

Although automobile upholsterers are employed throughout the country, most work in the larger cities.

Training, Other Qualifications, and Advancement

Most trimmers and installation men learn their skills on the job. Beginners, usually hired as trainees, first learn to remove seats and upholstery and install seat covers; they gradually advance to more difficult jobs, such as installing convertible tops. After qualifying as installation men, they make seat covers, tops, and other items. Although a capable beginner can become a fully qualified installation man in 3 to 6 months, 3 to 4 years usually are required to become a skilled trimmer.

A few automobile trimmers begin as apprentices. Apprenticeship programs, which usually last 3 to 4 years, consist of on-the-job training and classroom instruction.

Training programs for unemployed and underemployed workers for entry jobs as automobile trimmers were in operation in several cities in 1972 under the Manpower Development and Training Act. People who complete these programs, which usually last up to a year, may need additional on-the-job or apprenticeship training to qualify as skilled trimmers.

Applicants for entry jobs should be mechanically inclined and in good physical condition. Employers are interested in hiring those who enjoy working creatively with their hands. A high school education is desirable but not essential. High school and vocational school courses in furniture upholstering provide valuable training. Courses in mathematics are useful in laying out and planning upholstery work.

Experienced trimmers with supervisory ability may advance to foremen in large shops. Many automobile upholstery shops are owned by trimmers who acquired the necessary experience and funds to start their own businesses.

Employment Outlook

Employment of automobile trimmers and installation men is expected to increase slowly through the mid-1980's. Most job opportunities will result from the need to replace workers who retire, die, or transfer to other occupations.

Reasons for increased employment include a greater demand for truck cushions and tarpaulins and a greater demand for custom upholstery work in recreational vehicles such as motor homes, motorcycles, and boats. In addition, the growth of relatively new fields such as vinyl and sunroof installations is expected to increase employment.

Traditionally seat cover and convertible top installations have made up a large part of trim shop work. Recently, however, the number of new convertibles has declined sharply, and more durable fabrics are now used in automobile upholstery. As a result, the rate of increase for additonal trimmers and installation men will be less than the rate of growth in the number of motor vehicles.

Earnings and Working Conditions

According to information from a

limited number of automobile upholstery shops, beginners earned from $1.75 to $2.50 an hour in 1972. Experienced installation men earned $2.50 to $4.60 an hour, and skilled trimmers earned $4.00 to $7.75 an hour.

Most trimmers and installation men are paid a weekly salary or hourly wage and work from 44 to 48 hours a week. Many receive commissions or bonuses based on sales, in addition to their regular pay. Some trimmers are paid a straight commission.

Many employers provide paid holidays and vacations, and all, or part, of the cost of health and life insurance. Some also contribute to retirement plans.

Trimmers and installation men generally work in shops that are clean, well-lighted, and relatively quiet. They sometimes work in awkward or uncomfortable positions and are subject to minor cuts and bruises, but serious injuries are uncommon.

A small percentage of trimmers and installation men are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

More details about work opportunities may be obtained from local automobile upholstery shops or the local office of the State employment service. The State employment service also may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile trimmers and installation men may be obtained from:

National Association of Auto Trim Shops, 129 Broadway, Lynbrook, L.I., N.Y. 11563.

BLACKSMITHS

(D.O.T. 356.381 and 610.381)

Nature of the Work

Years ago the village blacksmith was as vital as the country doctor. No one else could repair a broken wagon wheel, shoe a horse, or forge a tool to suit a farmer's needs. Power hammers and ready-made horse shoes have made work easier, but the blacksmith's job has remained basically the same.

To make or repair metal parts, blacksmiths first heat the metal in a forge to soften it. When it begins to glow, they pick up the metal with tongs, place it on the anvil, and shape it with presses and power hammers. Broken parts are rejoined by hammering them together. The blacksmith uses handtools such as hammers and chisels to finish the part; he often reheats it in the forge to keep it soft and workable.

To harden a finished part, blacksmiths heat it to a high temperature in the forge and then plunge it into a water or oil bath. To temper the part—make it less brittle—they heat the metal to a lower temperature for some time, and then allow it to cool at room temperature.

An ancient skill practiced by many blacksmiths is shoeing horses; blacksmiths who specialize in this activity often are called farriers. After removing the old shoe blacksmiths examine the horse's hoof for bruises and clean, trim, and shape the hoof. When the hoof is ready they position and nail a shoe on the hoof and trim the hoof flush to the new shoe. Today most blacksmiths use ready-

made horse shoes, but they may have to make or adjust shoes for a proper fit.

The jobs of industrial blacksmiths and forge shop workers are similar. (For a detailed discussion of jobs in forge shops, see the statement on forge shop occupations elsewhere in the *Handbook*.)

Places of Employment

About 10,000 blacksmiths were employed in 1972. Almost two-thirds of them worked in factories, railroads and mines. The remainder worked in small shops, and most of them were self-employed.

Blacksmiths work in all parts of the country—in rural communities as well as in large industrial centers—and horseshoers are found in all States, especially near horse farms and race tracks.

Training, and other Qualifications

Most beginners enter the occupation by working as helpers in blacksmith shops. Others enter through formal apprenticeship programs which generally last 3 or 4 years. Apprenticeship programs usually teach blueprint reading, proper use of tools and equipment, heat-treatment of metal, and forging methods. Most apprentices are found in large industrial firms rather than in small repair shops. Vocational school or high school courses in metalworking, blueprint reading, and mathematics are helpful to young people interested in becoming blacksmiths.

Blacksmiths must be in good physical condition. Pounding metal and handling heavy tools and parts require considerable strength and stamina.

Opportunities for advancement are limited, especially for blacksmiths who work in small repair shops. However, blacksmiths may advance to be foremen or inspectors in factories, or to open their own repair shops.

Employment Outlook

Employment of blacksmiths is expected to decline slowly through the mid-1980's. However, a few hundred job openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

Employment is expected to decline because forge shops are producing many small metal articles formerly made by blacksmiths. Metalworking operations once performed only by blacksmiths are being done by other workers such as welders and forgeshop craftsmen. The skills of all-around blacksmiths, however, will continue to be required in the maintenance departments of large industrial firms and in many small metalworking and repair shops.

Earnings and Working Conditions

In union contracts covering a large number of blacksmiths in steel plants, railroad shops, and in the shipbuilding and petroleum industries, hourly pay ranged from $4.06 to $6.17 in 1972. Most contracts provide for 8 or 9 paid holidays a year and up to 5 weeks' vacation, depending on length of service. Other benefits include life insurance, hospitalization, and sickness and accident insurance, and pension plans.

Blacksmith shops tend to be hot and noisy, but conditions have improved in recent years because of large ventilating fans and less vibration from new machines. Blacksmiths are subject to burns from forges and heated metals and cuts and bruises from handling tools. Safety glasses, metal-tip shoes, face shields, and other protective devices have helped reduce injuries.

Many blacksmiths are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Other unions representing blacksmiths include the United Steelworkers of America, the Industrial Union of Marine and Shipbuilding Workers of America, and the International Union of Journeymen Horseshoers.

Sources of Additional Information

For details about training opportunities in this trade, contact local blacksmith shops and local offices of the State employment service.

BOILERMAKING OCCUPATIONS

Nature of the Work

Boilers, vats, and other large vessels that hold liquids and gasses are essential to many industries. Boilers, for example, supply the steam that drives the huge turbines in electric utility plants and ships. Tanks and vats are used to process and store chemicals, oil, and hundreds of other products. Layout men and fitup men help make the parts of these vessels, and boilermakers assemble them.

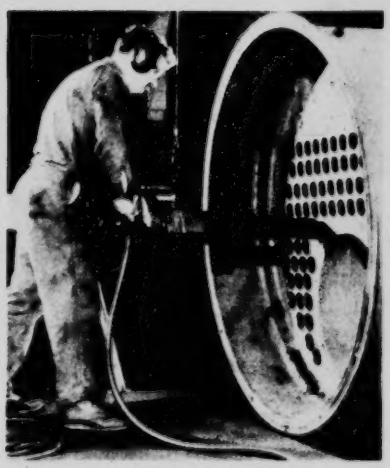
Layout men (D.O.T. 809.381 and .781) follow blueprints in marking off lines on metal plates and tubes. These lines serve as guides to other workers in the shop who cut and shape the metal. Layout men use compasses, scales, gages, and other devices to make measurements.

Their measurements must be precise because errors may be difficult or impossible to correct once the metal is cut.

Before the boiler parts are assembled, *fitup men* (D.O.T. 819.781) see that they fit together properly. These workers bolt or tack-weld the parts into place temporarily and alter those that do not line up according to blueprints. To make alterations, they use sledge hammers, drills, grinders, welding machines, cutting torches, and other tools.

Boilermakers (D.O.T. 805.281) assemble and erect large boilers in shops and at the construction sites where these vessels will be used. They lift heavy metal parts into place with rigging equipment such as hoists and jacks, and weld or rivet the parts together. After a boiler is completed, they test it for leaks and other defects.

Boilermakers also do repair jobs. After finding the cause of trouble, they may dismantle the boiler, patch weak spots with metal stock, replace detective sections with new parts, or strengthen joints. Installation and repair work often must meet State and local safety standards.



Places of Employment

About 33,000 boilermakers, layout men, and fitup men were employed in 1972. Several thousand boilermakers worked in the construction industry, mainly to assembly and erect boilers and other pressure vessels. Boilermakers also were employed in the maintenance and repair departments of iron and steel plants, petroleum refineries, railroads, and electric powerplants. Large numbers worked in Federal Government installations, principally in Navy shipyards and Federal powerplants. Layout men and fitup men worked mainly in plants that make fire-tube and water-tube boilers, heat exchangers, heavy tanks, and similar boiler-shop products.

Boilermakers work in every State, but employment is concentrated in States that are highly industrialized, such as Pennsylvania, California, Illinois, Ohio, New York, Texas, and New Jersey. Most layout men and fitup men also are employed in these States.

Training, Other Qualifications, and Advancement

Many workers have become boilermakers by working for several years as helpers to experienced boilermakers, but most training authorities agree that a 4-year apprenticeship is the best way to learn this trade. Apprenticeship programs usually consist of 4 years of on-the-job training, supplemented by about 150 hours of classroom instruction each year in subjects such as blueprint reading, shop mathematics, and welding.

Most layout men and fitup men are hired as helpers and learn the craft by working with experienced men. It generally takes at least 2 years to qualify as an experienced layout or fitup man.

When hiring apprentices or helpers, employers prefer high school graduates. Courses in mathematics, blueprint reading, and shopwork provide a useful background for all boilermaking jobs. Most firms require applicants to pass a physical examination because good health and the capacity to do heavy work are necessary in these jobs. Mechanical aptitude and manual dexterity also are important qualifications.

Layout men and fitup men may become boilermakers or shop foremen. Boilermakers may become foremen for boiler installation contractors; a few may go into business for themselves.

Employment Outlook

Employment in boilermaking occupations is expected to increase moderately through the mid-1980's. In addition to the job openings resulting from employment growth, several hundred openings will arise each year as experienced workers retire, die, or transfer to other fields of work.

Employment is expected to increase mainly because of the expansion of industries that use boiler products—particularly electric and gas utilities and the chemical, petroleum, steel, and shipbuilding industries. The development of atomic energy facilities may create a need for more boilermakers, layout men, and fitup men to manufacture and install boilers and related products. In shops that make boiler products, however, employment growth will be limited by more efficient production methods.

Earnings and Working Conditions

According to a national survey of

workers in the construction industry, union minimum wage rates for boilermakers in 54 large cities averaged $8.01 an hour in 1972, compared with $7.69 for all building trades journeymen. Average minimum hourly rates for boilermakers in 14 of these cities, selected to show how wages differ among various areas, appear in the accompanying tabulation.

City	*Rate per hour*
Atlanta	6.85
Baltimore	8.10
Boston	8.16
Chicago	8.35
Cleveland	8.71
Denver	7.80
Fresno	7.45
Houston	6.80
Kansas City	7.80
Los Angeles	7.20
New Orleans	6.80
Phoenix	7.20
Spokane	6.70
Syracuse	8.16

Comparable wage data were not available for boilermakers employed in industrial plants. However, wage rates were available from union contracts that cover many boilermakers, layout men, and fitup men employed in fabricated plate work and the petroleum and shipbuilding industries in 1972. Most of these contracts called for minimum hourly wage rates ranging from about $3.75 to $7.15. Generally, layout men received higher rates than boilermakers, and boilermakers received higher rates than fitup men.

Boilermakers, layout men, and fitup men in industrial plants usually work the same number of weekly hours as do other plant workers, generally 40 hours. Most union contracts covering these workers provide fringe benefits such as paid vacations, health and life insurance, and retirement pensions.

When assembling boilers or making repairs, boilermakers often work in cramped quarters or at great heights. Some work also must be done in damp, poorly ventilated places.

Boilermaking is more hazardous than many other metalworking occupations. Employers and unions attempt to eliminate injuries by promoting safety training and the use of protective equipment, such as safety glasses and metal helmets.

Most boilermaking workers belong to labor unions. The principal union is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Some boilermaking workers are members of [industrial unions, such as] the Industrial Union of Marine and Shipbuilding Workers of America; the Oil, Chemical and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

For further information regarding boilermaking apprenticeships or other training opportunities, inquiries should be directed to local construction companies and boiler manufacturers or the local office of the State employment service.

ELECTROPLATERS

(D.O.T. 500.380 and .782 through .886)

Nature of the Work

Electroplaters use plating solutions and electric current (electrolysis) to coat metal and plastic articles with chromium, nickel, silver, or other metal, to give the articles a protective surface or an attractive appearance. Products that are electroplated include items as widely different as automobile bumpers, silverware, costume jewelry, electronic components, and jet engine parts. Electroplaters also make items such as spray paint masks, turbine blades and pen caps, through a process known as electroforming.

Skill requirements and work performed vary by type of shop. All-round platers in small shops analyze solutions, do a great variety of plating, calculate the time and current needed for various types of plating, and perform other technical duties. They also may order chemicals and other supplies for their work. Platers in the larger shops usually carry out more specialized assignments that require less technical knowledge.

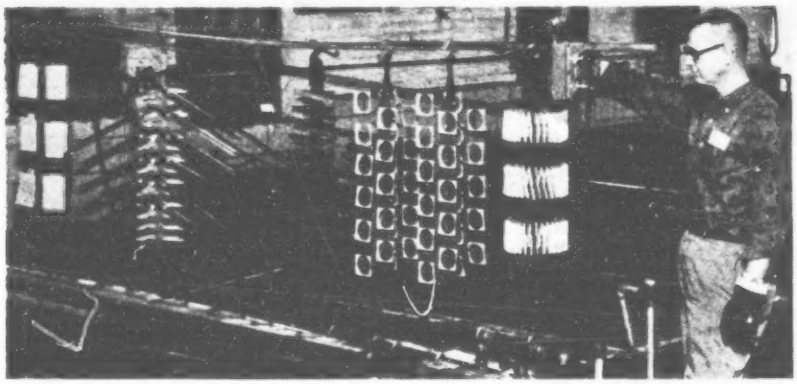
Before electroplaters coat an article, they first cover the parts not to be electroplated with lacquer, rubber, or tape. They then either scour the article or dip it into a cleaning bath, before putting it in the plating solution. They may remove the article from the solution from time to time to make sure that work is progressing satisfactorily.

Electroplaters must check many of the plated articles for defects. To determine the quality of the work, they use micrometers, calipers, and electronic devices.

Places of Employment

In 1972 there were about 37,000 electroplaters. About half of them worked in shops that specialized in metal plating and polishing for manufacturing firms and for other customers. The remaining platers were employed in plants that manufactured plumbing fixtures, cooking utensils, household appliances, electronic components, motor vehicles, and other metal products.

Electroplaters are employed in almost every part of the country, although most work in the North-



Electroplater prepares to immerse helicopter parts in nickel solution.

east and Midwest near the centers of the metalworking industry. Large numbers of electroplaters work in Los Angeles, San Francisco, Chicago, New York, Detroit, Cleveland, Providence, and Newark, N.J.

Training, Other Qualifications, and Advancement

Most electroplaters learn the trade on the job by helping experienced platers. It usually takes at least 3 years to become an all-round plater. Platers in large shops usually are not required to have an all-round knowledge of plating, and can learn their jobs in much less time.

A small percentage of electroplaters receive all-round preparation by working 3 or 4 years as an apprentice. Apprenticeship programs combine on-the-job training and related classroom instruction in the properties of metals, chemistry, and electricity as applied to plating. The apprentice does progressively more difficult work as his skill and knowledge increase. By the third or fourth year, he determines cleaning methods, does plating without supervision, makes solutions, examines plating results, and supervises helpers. Qualified platers may advance to be foremen.

A few people take a 1- or 2-year electroplating course in a junior college, technical institute, or vocational high school. In addition, many branches of the American Electroplaters Society give basic courses in electroplating. Young persons who wish to become electroplaters will find high school or vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading helpful.

Employment Outlook

Employment of electroplaters is expected to increase moderately through the mid-1980's. In addition, many openings will result from the need to replace experienced workers who retire, die, or transfer to other occupations.

Expansion of metalworking industries and the electroplating of a broadening group of metals and plastics are expected to increase the need for electroplaters. However, continuing mechanization, and the assignment of technical responsibilities to chemists and other personnel, will limit growth of this occupation.

Earnings and Working Conditions

Hourly wage rates for electroplaters ranged from $2.50 to $4.50 in 1972, according to the limited information available. During apprenticeship or on-the-job training, a worker's wage rate starts at about 60 to 70 percent of an experienced worker's rate and progresses to the full rate by the end of the training period.

Almost all plants pay shift premiums for night work. Many employers provide paid holidays and vacations and pay part or all of additional benefits such as life, health, and accident insurance.

Plating work involves some hazards because acid, alkaline, and poisonous solutions are used. Humidity and odor also are problems in electroplating plants. However, most plants have ventilation systems and other safety devices that have reduced occupational hazards. Protective clothing and boots provide additional protection. Generally, mechanical devices are used for lifting, but at times the worker must lift and carry objects weighing up to 100 pounds.

Some platers are members of the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, and the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

For educational information concerning electroplating and other metal finishing methods, write to:

American Electroplaters Society, Inc., 56 Melmore Gardens, East Orange, N.J. 07017.

For information on job opportunities and training, write to:

National Association of Metal Finishers, 248 Lorraine Ave., Upper Montclair, N.J. 07043.

FOREMEN

Nature of the Work

Foremen play an important role in the national economy. They supervise skilled, semiskilled, and unskilled blue-collar workers, and are often responsible for seeing that millions of dollars of equipment and material are used efficiently. They may oversee workers assembling television sets, servicing automobiles, laying bricks, unloading ships, or any thousands of other activities. Foremen are known by different titles. For example, in the textile industry they are referred to as second hands; aboard ship they are called boatswains; and in construction they are known as overseers, strawbosses, or gang leaders.

Supervision is the most important part of the foremen's job. Many blue-collar workers never work for supervisors higher than foremen, and it is through their foremen that they get work orders, recognition, and discipline. Foremen interpret and communicate company policy to the workers. They also train newly hired workers and advise experienced workers on the proper way to handle jobs. In some cases, foremen also work at specific crafts. "Working foremen" are common in construction, where, for example, bricklayer foremen lay brick as well as supervise journeymen bricklayers and helpers.

Foremen must plan and schedule the work of their subordinates and keep production and employee records. They must use considerable judgment in their planning and allow for unforeseen problems such as absenteeism and machinery breakdown. Foremen participate in meetings and prepare reports on production, costs, personnel, and safety.

Foremen see that safety rules and regulations are followed and instruct employees in safety practices. In unionized plants, foremen may meet with union representatives to discuss work problems and grievances. They must know the rules of labor-management agreements and run their operation according to the agreements.

Places of Employment

Foremen work for almost all businesses and government agencies that employ blue-collar workers. About 1.4 million were employed in 1972; about 93 percent were men.

Foremen work mainly in the highly industrialized sections of the Nation. About three-fifths work for the following manufacturing industries: machinery, metals, transportation equipment, food, chemicals, and paper products. Large numbers also are found in the construction, trade, and service industries. Many female foremen, or forewomen, work for the apparel, electrical machinery, leather products, and laundry and drycleaning industries.

Training, Other Qualifications, and Advancement

When choosing foremen, employers generally look for experience, skill, and leadership ability. Especially helpful are the abilities to motivate employees, to command respect, and to get along with people.

Most foremen rise through the ranks—that is, they are promoted from the machine, work bench, or a construction craft. By working at different jobs over a period of time, they develop many skills and gain a thorough knowledge of the jobs they supervise. During this time, they also learn much about their fellow workers, and about management policies and employee attitudes toward these policies. Very often, foremen are former union members who have served as elected representatives and learned about grievance procedures, collective bargaining, and labor-

management contracts.

The experience gained by rising through the ranks gives foremen the advantage of knowing how a job should be done and possible problems involved, and helps them know what to expect from the workers they supervise.

Although fewer than one-tenth of all foremen are college graduates, a growing number of employers are hiring foremen trainees with college backgrounds. This practice is most prevalent in industries that have highly technical production processes such as the chemical, oil, and electronics industries. Employers generally look for college graduates with backgrounds in business administration, industrial relations, mathematics, engineering, or science. Foremen trainees undergo on-the-job training until they are able to accept supervisory responsibilities.

Foremen with outstanding ability, particularly those with college education, may move up to higher management positions. In manufacturing, for example, they may advance to jobs such as department head, general foreman, and plant manager. In the construction industry, some foremen use the experience and skills they gain to go into business for themselves.

Employment Outlook

Employment of foremen is expected to increase moderately through the mid-1980's. In addition, many job openings will arise as experienced foremen retire, die, or transfer to other occupations.

Growth of business and government organizations will create a demand for more foremen. Demand also will be stimulated by the trend toward more complex production processes that require greater supervision.

Most foremen will continue to work in manufacturing. However, a large part of the increase in foremen jobs will be due to the rapid expansion of nonmanufacturing industries—construction, trade, service, and public utilities. The number of foremen in construction is expected to grow very rapidly.

Earnings and Working Conditions

In 1971, the average (median) earnings of foremen who worked full time was $10,410, compared with $7,965, in all occupations. Foremen usually are salaried and not paid for overtime. Their salary levels generally are keyed to the wage rates of the highest paid workers they supervise. Some companies keep wages of foremen about 10 percent to 30 percent higher than those of workers they supervise.

Working conditions of foremen vary widely from industry to industry. Since they are the first level of supervision, foremen must spend much time with workers on the plant floor or at the construction site. Plant foremen are apt to get dirty around machinery and materials and have to put up with noisy manufacturing operations. Construction foremen often work in unpleasant weather. Foremen generally work more than 40 hours a week and are expected to be on the job before the workers arrive, and after they leave.

Some foremen who have limited authority may feel isolated, neither a member of the work force nor an important part of management. On the other hand, foremen have more interesting and challenging jobs and more prestige than blue-collar workers.

Sources of Additional Information

More facts about foremen are available from:

American Management Association, 135 West 50th Street, New York, N.Y. 10020.

FORGE SHOP OCCUPATIONS

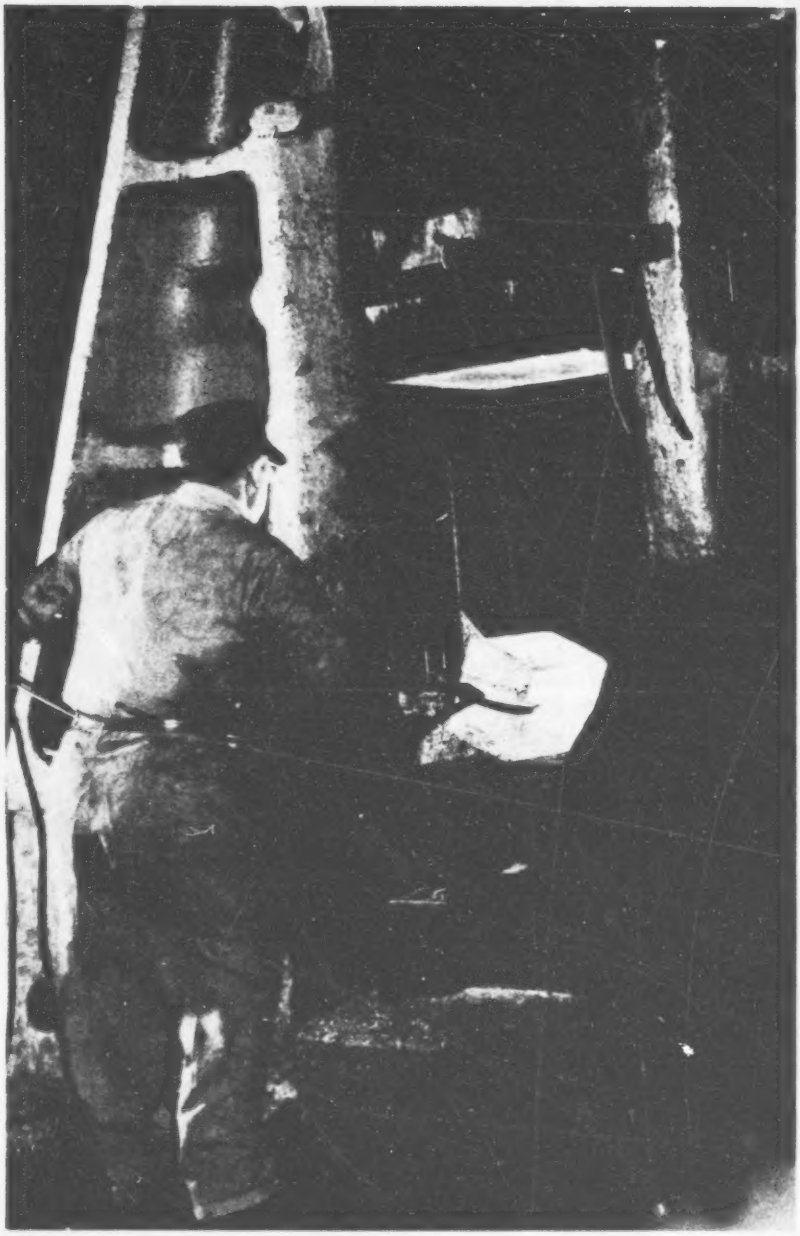
Forging is one of the oldest methods of working and shaping metals. The simplest way is the hand forging done by a blacksmith. Modern forge shops substitute heavy power equipment and dies (tools that shape metal) for the blacksmith's hammer and anvil. Five men operating a large forging machine can turn out more forgings in one hour than five blacksmiths can make in a year.

Forged metal is exceptionally strong and is used for many products that take heavy wear. Examples include automobile crankshafts, gears, wrenches, scissors, and many aerospace equipment parts. Most forgings are steel; but aluminum, copper, brass, bronze, and other metals are forged also. Forgings vary in weight from ounces to many tons.

Nature of the Work

Before metal can be shaped, it must be heated in intensely hot furnaces (forges). Then workers manipulate the glowing metal between two metal dies that are attached to power presses or hammers. With tremendous force, the hammers or presses pound or squeeze the metal into the desired shape. To finish the forging, other workers remove rough edges and excess metal and perform other finishing operations such as heat treating and polishing.

Two kinds of dies are used. The open die, which is flat and similar to the blacksmith's hammer, is used



when small numbers of forgings or large size forgings are needed. The impression or closed die, which has a cavity shaped to the form of the metal part, is used to produce large quantities of identical parts.

Basic forge-shop equipment consists of various types of power hammers, power presses, dies, and furnaces. Forge-shop workers also use hand tools, such as hammers and tongs, and measuring devices, such as rules, scales, and calipers. From two to ten men make up a hammer or press crew, depending on the size and type of equipment and the size and shape of the metal being formed. Descriptions of some major forge-shop production occupations follow.

Hammersmiths (D.O.T. 612.381) direct the operation of open die power hammers. They interpret blueprints, drawings, and sketches so that the part being forged will meet specifications. They decide the amount of hammer force, and if and when the metal needs additional heating. Hammersmiths determine how to work the metal under the hammer and which tools are needed to produce desired angles and curves.

Hammersmiths head crews of four or more workers. A hammer driver or hammer runner regulates the force of the forging blow. A craneman transfers the metal from the furnace to the hammer and manipulates it under the hammer. A heater controls the furnace that brings the metal to correct forging temperatures. One or more helpers assist the crew as needed.

The duties of *hammer operators* (D.O.T. 610.782), or hammermen, who operate impression die power hammers, are similar to those of hammersmiths at open die power hammers. Generally, the bigger the hammer and the larger or more intricate the shape to be formed, the greater the skill required of the operator. With the assistance of helpers and heaters, hammermen set and align dies in the hammers. They control the force of the forging blow, manipulate the metal under the hammer, and determine if and when the metal needs additional heating.

Press operators (D.O.T. 611.782 and .885) control huge presses equipped with either impression or open dies that press and squeeze hot metal rather than hammer or pound it. They regulate machine pressure and move the hot metal between the dies. They may control the metal heating operations. Some operators set up the dies in the presses. Their

skills are very similar to those of either hammersmiths or hammermen.

With the help of heaters and several helpers, *upsetters* (D.O.T. 611.782), or upsettermen, operate machines that shape hot metal by applying horizontal pressure. The heads of nails and bolts, for example, are made by upset forging.

Heaters (D.O.T. 619.782) control furnace temperatures. They determine when the correct temperature has been reached by observing the metal's color and the furnace's temperature gauge. Using tongs or mechanical equipment, they transfer the hot metal from the furnace to hammers or presses. Some heaters clean furnaces.

Inspectors (D.O.T. 612.281) examine forged pieces for accuracy, size, and workmanship. They use gauges, micrometers, and calipers to measure forgings. Machines that test strength and hardness and electronic testing devices also may be used.

Die sinkers (D.O.T. 601.280) make the impression dies for the forging hammers and presses. Working from a blueprint, drawing, or template, these skilled workers make an outline of the object to be forged on two matching steel blocks. They form the object's shape in the blocks by using milling machines and other machine tools such as EDM (electrical discharge machinery) and ECM (electrical chemical machinery). Using scrapers, grinders, and other handtools, die sinkers smooth and finish the die cavity. Finally, a sample is prepared from the finished cavity and is checked against specifications.

Many forge-shop workers clean and finish forgings. For example, *trimmers* (D.O.T. 617.885) remove excess metal with presses equipped with trimming dies. *Grinders* (D.O.T. 705.884) remove rough edges with power abrasive wheels. *Sandblasters* or *shotblasters* (D.O.T. 503.887) operate sandblasting or shotblasting equipment that cleans and smoothes forgings. *Picklers* (D.O.T. 503.885) dip forgings in an acid solution to remove surface scale and reveal any surface defects. *Heat treaters* (D.O.T. 504.782) heat and cool forgings to harden and temper the metal.

Places of Employment

In 1972, about 63,000 production workers were employed in forge shops. Nearly three-fourths of these worked in shops that make and sell forgings. The remainder worked in plants that use forgings in their final products, such as automobiles, farm equipment, and hand tools.

Although forge-shop workers are found in all States, they are concentrated near steel-producing centers that provide the steel for the forgings, and near metalworking plants that are the major users of forged products. Large numbers of forge-shop workers are employed in Pennsylvania, Ohio, Illinois, Michigan, Wisconsin, Massachusetts, California, and New York.

Training, Other Qualifications, and Advancement

Most forge-shop workers learn their skills on the job. They generally join hammer or press crews as helpers or heaters. As they become experienced, they progress to other jobs. Advancement to hammersmith, for example, requires several years of on-the-job training and experience.

Some forge shops offer apprentice training programs for skilled jobs such as die sinker, heat treater, hammer operator, hammersmith, and press operator. Apprenticeships usually last 4 years. These programs provide classroom training and practical experience in metal properties, power hammer and furnace operation, hand tool use, and blueprint reading.

Training requirements for inspectors vary. Only a few weeks of on-the-job training is necessary for those who make examinations visually or with simple gauges. Others who inspect forgings made to exact specifications may need some background in blueprint reading and mathematics, and may be given several months of training.

Employers usually require no more than a grammar school education for helpers and heaters, but high school graduates are preferred. Young people interested in more skilled forge-shop jobs should complete high school and take mathematics (especially geometry), drafting, and shopwork.

Although cranes are used to move very large objects, forge-shop workers must be strong enough to lift and move heavy forgings and dies. They need stamina and endurance to work in the heat and noise of a forge shop.

Employment Outlook

Employment of forge-shop production workers is expected to increase slowly through the mid-1980's. Most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work.

Employment will grow because of expansion in industries that use forgings, particularly machinery and automobile industries. However, employment will increase much more slowly than forge shop production, because improved forging techniques and equipment will result in greater output per worker. Because forge-shop production is sensitive to changing business conditions, some forge-shop workers may be laid off periodically.

Earnings and Working Conditions

Average hourly earnings of forge-shop production workers are higher than the average for all manufacturing production workers. In 1972, production workers in iron- and steel-forging plants averaged $5.04 an hour, compared with $3.81 an hour for production workers in all manufacturing industries.

Most forge shops provide various fringe benefits such as paid holidays, vacations, and retirement pensions. Other important benefits include health and medical insurance and life insurance.

Many forge shops have heat deflectors and ventilating fans to reduce heat and smoke. Improvements in machinery and shop practices have reduced some noise and vibration. Further improvements, particularly in noise levels, will be made to meet the standards of the new Occupational Safety and Health Act. Labor and management cooperate to encourage good work practices through safety training and the required use of protective equipment such as face shields, ear plugs, safety glasses, metal-toe shoes, helmets, and machine safety guards.

Most forge shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Others are members of the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Die Sinkers' Conference (Ind.).

Sources of Additional Information

Further information on employment opportunities in forging can be obtained from local offices of the State employment service, personnel departments of forge shops, locals of the labor organizations listed above, or from:

The Forging Industry Association, 55 Public Square, Cleveland, Ohio 44113.

The Open Die Forging Institute, 120 East Ogden Ave., Hinsdale, Ill. 60521.

FURNITURE UPHOLSTERS

(D.O.T. 780.381)

Nature of the Work

Furniture upholsterers recondition sofas, chairs, and other upholstered furniture. These craftsmen repair or replace fabrics, springs, webbing, frames, and other parts that are worn or damaged. (Workers employed in the manufacture of upholstered furniture are not included in this statement.)

In order to work at a convenient level, upholsterers usually place the furniture on which they are working on padded wooden horses. Using tack pullers or chisels and mallets, they pull out the tacks holding the old fabric in place and remove the fabric. They may then remove the padding and burlap to uncover the springs. Broken or bent springs are removed. If the webbing that holds the springs in place is worn, the workers remove all the springs and the webbing. Upholsterers then repair the frame, as well, by regluing loose sections and refinishing exposed wooden parts.

In reupholstering furniture, they first tack strips of webbing to the frames. Next, they sew new springs to the webbing and tie each spring to the adjoining ones, securing the outside springs to the frame. They use burlap, filling, and padding to cover the springs, and sew the padding to the burlap. Finally, after covering the padding with muslin and new upholstery fabric, they attach these materials to the frame and make sure everything is smooth and tight. They complete the job by sewing or tacking on fringe, buttons, or other ornaments.

Upholsterers use a variety of handtools including tack and staple removers, pliers, hammers, and hand or power shears. They also use special tools such as webbing stretchers and upholstery needles. They may also use sewing machines.

Sometimes upholsterers pick up and deliver furniture. Those who own shops order supplies and equipment, keep business records, and perform other managerial tasks.

Places of Employment

About 35,000 people worked as furniture upholsterers in 1972. Over half worked in small upholstery shops, most of which had less than eight employees. Many upholsterers also worked for furniture stores. Also, businesses that maintain their own furniture, such as theaters and hotels, employed a few upholsterers.

Geographically, employment of upholsterers is distributed in about the same proportion as population.

Training, Other Qualifications, and Advancement

The most common way to enter this trade is to start as a helper in an upholstery shop and learn on the job. Newly hired helpers do simple jobs, such as removing old fabric, padding, and springs. As they gain experience, they do more complex tasks, such as installing webbing and springs, and sewing on fabric and trimming. A skilled upholsterer

Upholsterer tacks new material on chair.

needs about 3 years of on-the-job training.

Inexperienced persons can learn many skills of the trade by working in furniture factories and performing a variety of jobs closely related to furniture upholstering. They may get valuable training, also, in vocational or high school courses that include chair caning, furniture making, textile fabrics, and upholstery repair. However, additional training and experience in a shop is usually required before these workers can qualify as skilled upholsterers. A few people learn the trade through formal apprenticeship programs that last from 3 to 4 years and include classroom instruction as well as on-the-job training.

Young persons interested in becoming upholsterers should have good manual dexterity and be able to do occasional heavy lifting. An eye for detail, good color sense, and a flair for creative work are helpful.

Upholsterers usually buy their handtools, but employers provide power tools.

Many upholsterers open their own shops. Almost one out of every three upholsterers is self-employed—a much higher proportion than in most other trades.

Employment Outlook

Employment of upholsterers is expected to grow slowly through the mid-1980's. Most job openings will arise because of the need to replace experienced workers who retire, die, or transfer to other occupations.

The amount of upholstered furniture in houses and businesses will increase as population, personal income, and business expenditures grow. More durable fabrics and the trend to buying new furniture instead of having old pieces reupholstered, however, will limit the demand for upholsterers.

Earnings and Working Conditions

Earnings data for furniture upholsterers are not available on a national basis. However, information from union contracts covering many of these workers in 1972 indicated that hourly rates for helpers ranged from $2.20 to $4.50, and for experienced upholsterers from $3.25 to $4.95. Hourly rates in the South were generally lower than those in the North and West. A few upholsterers were paid on a piece-work basis.

Upholsterers generally work 40 hours a week, although overtime is common during the weeks before major holidays. Many upholsterers received paid vacations and sick leave, and some are covered by health insurance plans.

Many upholstery shops are spacious, adequately lighted, and well ventilated and heated. However, the workshop's air may contain dust from padding and stuffing. In addition, upholsterers stand while they work and also do a considerable amount of stooping and bending. The work generally is safe, although minor cuts from sharp tools and back strain from lifting heavy furniture are not uncommon.

Sources of Additional Information

For more details on work opportunities for upholsterers, contact local employers or the local office of the State employment service.

INSPECTORS (MANUFACTURING)

Nature of the Work

Most products—including the things we eat, drink, wear, and ride in—are checked by inspectors sometime during the manufacturing process to make sure they are of the desired quality. Inspectors also check the quality of the raw materials and parts that make up finished goods.

Inspectors use a variety of methods to make certain that products meet specifications. They may merely look for flaws, imperfections, or defects; or they may use gauges, micrometers, and other instruments to examine parts and materials. They may read work orders or blueprints and do calculations using decimals or common fractions when measuring. They may use handtools, such as screwdrivers, magnifying glasses, and tweezers.

Skilled inspectors work under general supervision, whereas semiskilled inspectors usually work under close supervision. Generally, skilled inspectors have greater discretion in accepting or rejecting products, and are responsible for inspecting the most important parts of mass-produced goods. Skilled inspectors also use a wider variety of testing instruments.

Many inspectors count the items rejected. When the number rises above a certain level, they notify their supervisors so that corrections can be made on the production line. Some inspectors make minor repairs and adjustments and grade products for quality.

Places of Employment

In 1972, most of the approximately 725,000 inspectors—two-fifths of them women—worked in plants that produced durable goods such as machinery, transportation equipment, electronics equipment, and furniture. Others were employed in plants that produced goods such as textiles, apparel, drugs, and leather products.

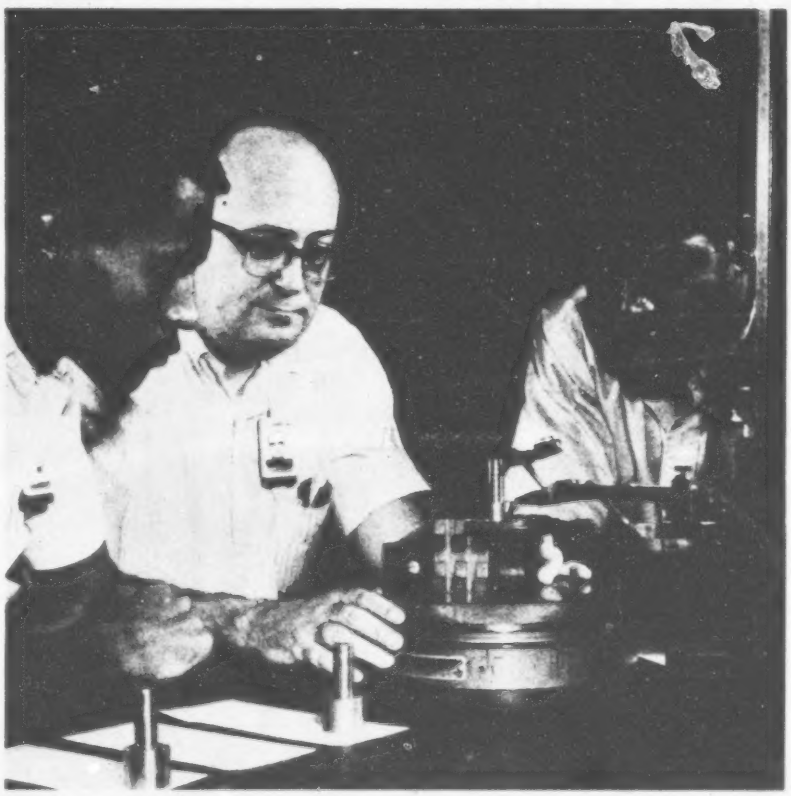
Inspectors worked in every part of the country. The largest numbers are found in heavily industrialized States such as Ohio, New York, Michigan, Illinois, Pennsylvania, California, and New Jersey.

Training, Other Qualifications, and Advancement

Inspectors generally are trained on the job for a brief period—from a few hours or days to several months, depending upon the skill required.

Employers look for applicants who have good health and eyesight, can follow directions, and can concentrate on details. Applicants should be able to get along with people since inspectors work occasionally as part of a team. A few large companies give preemployment tests to check such skills as the ability to work with numbers. Some employers may hire applicants who do not have a high school diploma but who have qualifying aptitudes or related experience. Other employers prefer experienced production workers for inspection jobs.

Some semiskilled inspectors—particularly in metalworking industries—who take courses, such as blueprint reading and shop mathematics, may advance to skilled inspectors or quality control technicians. After acquiring sufficient ex-



Inspector shows trainee how to check machined parts.

perience and knowledge, a few become foremen.

Employment Outlook

Employment of inspectors is expected to increase moderately through the mid-1980's, with thousands of openings each year. Additional openings will result as workers retire, die, or transfer to other occupations.

Most of the industries that employ these workers are expected to increase their employment in the long run. The growing complexity of manufactured products should also result in a need for more inspectors. However, increasing use of mechanized and automatic inspection equipment will limit employment growth.

Earnings and Working Conditions

According to limited information, average hourly rates for inspectors ranged from about $3 to $6 in 1972, depending on skill level, type of product inspected, geographic area, and industry.

Working conditions vary considerably for inspectors. For example, some have well lighted, air conditioned workplaces in an aircraft or missile plant; others, who work on the production floor of a machinery or metal fabricating plant, often are exposed to high temperatures, oil, grease, and noise.

Many inspectors are members of labor unions, including the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers. Most union contracts provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Sources of Additional Information

Information about employment opportunities in this field may be available from local offices of the State employment service.

The American Society for Quality Control certifies quality technicians. Information about the test required for certification may be obtained by writing to:

American Society for Quality Control,
161 West Wisconsin Ave.,
Milwaukee, Wisc. 53203.

MILLWRIGHTS

(D.O.T. 638.281)

Nature of the Work

Millwrights are skilled craftsmen who move and install heavy industrial machinery. They must know how to dismantle, reassemble, and align complex equipment. To assemble machinery, millwrights fit bearings, align gears and wheels, attach motors, and connect belts. They often construct concrete foundations and platforms and fabricate metal framework on which machinery is mounted. Millwrights must be able to read blueprints and work with wood, steel, concrete, and

Millwrights move machinery into place.

other building materials.

To move machinery, millwrights use hoists, jacks, wood blocking, and other rigging devices. To dismantle and assembly equipment they use wrenches and other handtools and portable power tools. They also use calipers, squares, plumb bobs, and other devices to align and level machinery.

Millwrights employed by contract installation and construction companies do a variety of installation work. Those employed in factories usually specialize in installing the particular types of machinery used by their employers. They also may maintain plant equipment such as conveyors and cranes.

Places of Employment

Most of the estimated 85,000 millwrights employed in 1972 worked for manufacturing companies; the majority were in metal, paper, lumber, and chemical products industries. Others worked for contractors in the construction industry. Machinery manufacturers employed a small number to install equipment in customers' plants.

Millwrights work in every State. However, about half of them are employed in the heavily industrialized State of Michigan, Ohio, Pennsylvania, Illinois, New York, and Indiana.

Training, Other Qualifications, and Advancement

Most millwrights start as helpers to skilled workers and learn the trade on the job. Others learn through formal apprenticeship programs. Apprenticeship programs generally last 4 years and include training in dismantling, moving, eracting, and repairing machinery. They also may work with concrete and receive instruction in related skills such as carpentry. Classroom instruction is given in shop mathematics, blueprint reading, hydraulics, electricity, and safety. Many companies require that applicants be high school graduates between the ages of 18 and 26.

High school courses in science, mathematics, mechanical drawing, and machine shop practice are useful. Because millwrights often put together and take apart complicated machinery, mechanical aptitude is important. Strength and agility also are important, because the work requires considerable lifting and climbing.

Employment Outlook

Employment of millwrights is expected to increase moderately through the mid-1980's as new plants are built, as plant layouts are changed, and as additional complex machinery is maintained. A few thousand openings will arise annually as millwrights retire, die, or transfer to other occupations.

Earnings and Working Conditions

In 1971-72, hourly wages for millwrights in all industries averaged about $5.00, which was considerably higher than the average wage for other production or nonsupervisory workers. Straight-time hourly earnings for millwrights in 12 cities that represent various regions of the country, appear in the accompanying tabulation:

City	*Rate per hour Industrial millwrights (all industries)*
Canton, Ohio	$4.78
Boston, Massachusetts	3.89
Buffalo, New York	4.61
Houston, Texas	5.24
Los Angeles-Long Beach and Anaheim-Santa Ana-Garden Grove, California	5.54
Louisville, Kentucky	5.29
Minneapolis-St. Paul, Minnesota	4.97
New Haven, Connecticut	4.12
New Orleans, Louisiana	4.50
St. Louis, Missouri	5.09
Trenton, New Jersey	4.81

Millwrights employed by construction companies usually have higher wage rates than those in manufacturing. The minimum average hourly rates for millwrights under union contracts in construction ranged from $5.45 to $9.07 in 1972, according to a national survey of building trades workers in 68 large cities.

Apprentices generally start at 50 percent or more of the skilled worker's rate and receive periodic increases over that rate by the end of their training period.

Millwrights employed by factories ordinarily work year round. Those employed by construction companies and those companies that manufacture and install machinery may have periods of unemployment. Frequently they work away from home.

The work of millwrights involves some hazards. For example, there are dangers of being struck by falling objects or by machinery that is being moved. There also is the danger of falling from high work places. In addition, millwrights are subject to usual shop hazards such as cuts and bruises. Accidents have been reduced by the use of protective devices such as safety belts and hats.

Most millwrights belong to labor unions, among which are the International Association of Machinists and Aerospace Workers; United Brotherhood of Carpenters and Joiners of America (construction millwrights); United Steelworkers of America; International Union, United Automobile, Aerospace and Agricultural Implement Workers of

America; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; and the International Union of Electrical, Radio and Machine Workers. Employer-union contracts usually provide for benefits such as paid holidays and vacations.

Sources of Additional Information

Further information on apprenticeship programs may be obtained from:

United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, D.C. 20001.

MOTION PICTURE PROJECTIONISTS

(D.O.T. 960.382)

Nature of the Work

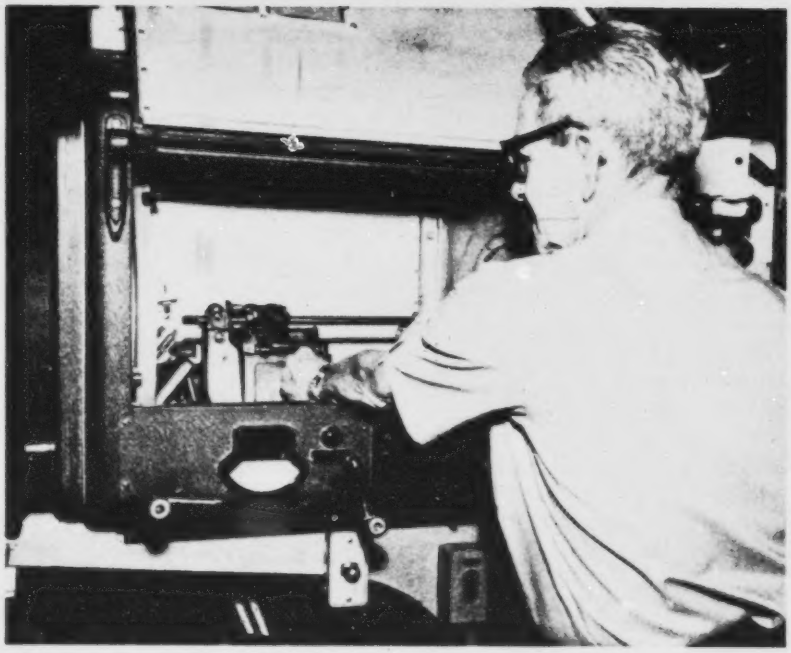
Projectionists are key behind-the-scenes workers in motion picture theaters. From a room high in the back of the theater, the projectionist operates the movie projectors and sound equipment.

To show a feature-length movie, projectionists use two projectors, sound equipment, a film rewinding machine, and seven or more reels of film. Before the movie begins, they check the equipment to see that it works properly, and load the projectors with the first and second reels. Most projectors burn a carbon rod to provide light for the screen. After igniting and adjusting the rod, projectionists start the first reel. If the picture is out of focus or unsteady they adjust the projector lens.

A reel of film lasts about 20 minutes. When the reel is almost complete, cue marks (small circles in the upper right corner of the picture) signal that it is time to start the second projector. When a second series of cue marks appears, the projectionist simultaneously closes the shutter on the first projector and opens the second one. This changeover happens so quickly that the audience does not notice an interruption on the screen. Next, the projectionist removes the used reel and rewinds it on the rewinding machine. The entire process is repeated until all the reels have been shown. When film breaks, the projectionist must rapidly rethread it so that the show may continue.

Some new theaters, especially multiscreen ones, have automatic equipment that reduces the projectionist's workload. Some machines, for example, automatically change reels.

Projectionists clean and lubricate equipment, check for defective parts and damaged film, and make minor repairs and adjustments. For example, they may replace a badly worn projector sprocket. Major repairs are made by servicemen who specialize in projection and sound equipment.



Projectionist adjusts arc lamp in projector.

Places of Employment

An estimated 16,000 full-time motion picture projectionists—nearly all of them men—were employed in 1972. More than three-fourths worked for indoor theaters; most of the remainder worked for drive-ins. Some projectionists worked in large manufacturing companies, television studios, and in Federal, State, and local governments. Although many theaters employ one projectionist for each shift, the larger theaters have two. A few employ more than two projectionists.

Projectionists work in cities and towns of all sizes throughout the country. In theaters located in small towns, theater owners or members of their families may do projectionist work.

Training, Other Qualifications, and Advancement

Most theaters in urban areas are unionized and young people who want jobs as projectionists must complete a union apprenticeship program. In nonunion theaters, young people may start as an usher or helper and learn the trade by working with an experienced projectionist.

Unions require applicants to be 18 and prefer high school graduates. The apprenticeship training usually lasts 1 to 2 years depending on the policy of the local. After training, the apprentice must pass an exam for union membership. In some cases, a capable apprentice may be assigned to a full- or part-time job at journeyman's pay before becoming a union member. In a few cities and States, projectionists must be licensed.

Apprentices learn the trade by working with experienced projectionists. They first learn simple tasks, such as threading and rewinding film. With experience they progress to more difficult assignments, such as adjusting and repairing equipment. An apprentice may work in several theaters to become familiar with different types of equipment. Some apprentices are not paid during training.

Young people interested in becoming projectionists should have good eyesight, including normal color perception, and good hearing. They should be temperamentally suited to working along and in close quarters. Manual dexterity and mechanical aptitude are also important personal qualifications. Practical experience gained from operating small movie projectors at home, at school, or in the Armed Forces also is helpful. Advancement opportunities for projectionists are very limited. A few, however, become theater managers.

Employment Outlook

Employment of motion picture projectionists will gorw slowly through the mid-1980's. Most job openings will occur as experienced workers retire, die, or transfer to other fields of work.

The number of movie theaters is expected to grow as more are built in suburban areas but employment of projectionists will grow slowly this growth. In many new shopping centers, several theaters are being built side by side so that one projectionist can take care of more than one theater.

Earnings and Working Conditions

Average hourly earnings for projectionists in large metropolitan areas ranged from $4.10 to $9.19 in 1972, according to information from several union contracts. Generally, downtown multiscreen theaters pay higher hourly rates than suburban or drive-in theaters.

Most projectionists work evenings; generally 4 to 6 hours, 6 evenings a week. They may work more than 6 hours on Saturday and Sunday in theaters that feature matinees. Some projectionists work at several theaters. For example, a weekly schedule may call for two evenings in each of three theaters. Projectionists employed in drive-in theaters, particularly those in northern States, may be laid off for several months during the winter.

Many projectionists receive 2 or 3 weeks of paid vacation and premium pay for weekend or holiday work. Some are covered by hospitalization and pension plans.

Projection rooms usually have adequate lighting and ventilation, and many are air-conditioned. The work is not strenuous and is relatively hazard free, but there is some danger of electrical shocks and burns if proper safety precautions are not taken. Although projectionists must stand up a lot, they can sit for short periods while the equipment is operating. Most projectionists work without direct supervision and have infrequent contact with other theater employees.

Sources of Additional Information

Details about apprenticeship programs and employment opportunities may be obtained from any local of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada.

PHOTOGRAPHIC LABORATORY OCCUPATIONS

(D.O.T. 970.281, 976.381, .687 through .887)

Nature of the Work

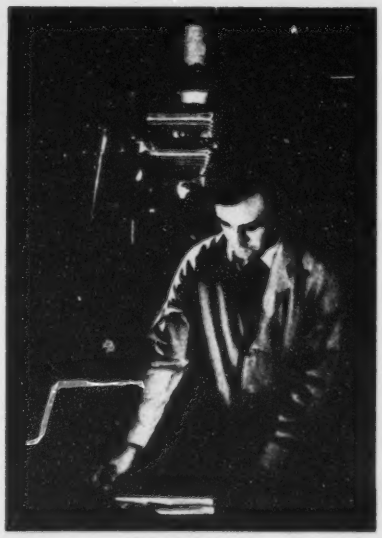
Amateur snapshots, home movies, professional portraits, and photographs to illustrate publications require the skills of thousands of photographic laboratory employees. These workers develop film, make prints and slides, and perform related tasks, such as enlarging and retouching photographs. (This chapter does not discuss employees of laboratories that specialize in processing professional motion picture film.)

All-round darkroom technicians (D.O.T. 976.381) can perform all tasks necessary to develop and print film. The technician varies the developing process according to the type of film—black-and-white negative, color negative, or color positive. For example, a developing process

for black-and-white negative film covers five steps: developer, stop bath, fixing bath, washing, and drying. The first three steps use chemical solutions and are performed in darkness. After unwinding a roll of film, the technician places it in the developer, a solution that brings out the image on exposed film. After the film has remained in the developer for a specified period, the technician transfers it to a stop bath to prevent over-development. Next, the film is placed in a fixing bath that makes it insensitive to light, thus preventing further exposure. Finally, the technician washes the film with water to remove the fixing solution and places the film in a drying cabinet. In many photographic labs, technicians regulate machines that automatically perform the steps described above.

Processes for developing color films are more complex than those used for black-and-white. Thus, some labs employ *color technicians* (D.O.T. 976.381)—highly skilled workers who specialize in processing color film.

The darkroom technician makes a photograph by transferring the image from a negative to photographic paper. Printing frequently is performed on a projection printer, which consists of a fixture for holding negatives and photographic paper, an electric lamp, and a magnifying lens. The technician places the negative between the lamp and lens, and the paper below the lens. When he turns on the lamp, light passes through the negative and lens and records a magnified image of the negative on the paper. During printing, the technician may vary the contrast of the image or remove unwanted background by using his hand or paper patterns to shade part of the photographic paper from the projected image. After removing the exposed photographic paper from the printer, he develops it in much the same way as the negative. If the customer desires, the technician mounts the finished print in a frame or on a paper or cardboard back.



Darkroom technician makes print.

In addition to working in the laboratory, darkroom technicians may set up lights and cameras or otherwise assist experienced photographers. Many technicians, particularly those in portrait studios, divide their time between taking and processing pictures. In some labs, helpers assist technicians. They also may be assisted by workers who specialize in a particular activity, such as *developers* (D.O.T. 976.381), *printers* (D.O.T. 976.381), and *retouchers* (D.O.T. 970.281).

In most large photo labs, darkroom technicians supervise semiskilled workers who perform specialized assignments that require only a limited knowledge of developing and printing. Included are *film numberers* (D.O.T. 976.887), who sort film according to the type of processing needed and number each roll for indentification; *film strippers*, who unwind rolls of film and place them in developing machines; *printer operators* (D.O.T. 976.782), who operate machines that expose rolls of photographic paper to negatives; *print developers, machine* (D.O.T. 976.885), who operate machines that develop these rolls of exposed photographic paper; *chemical mixers* (D.O.T. 976.884), who measure and combine the various chemicals that make up developing solutions; *slide mounters*, who operate machines that cut, insert, and seal film in cardboard mounts; and *photocheckers and assemblers* (D.O.T. 976.687), who inspect the finished slides and prints and package them for customers.

Places of Employment

In 1972, about 38,000 persons worked in photo lab occupations. More than half of them were in semiskilled photofinishing occupations; the remainder were darkroom technicians.

Most semiskilled workers are employed by large commercial labs that specialize in processing film for amateur photographers. A large proportion of darkroom technicians work in photo labs operated by portrait and commercial studios and by manufacturers, newspaper and magazine publishers, advertising agencies, and other organizations. Darkroom technicians also work in commercial labs that specialize in processing the work of professional photographers.

Photo lab jobs can be found throughout the country, but employment is concentrated in the more populous cities and States.

Training, Other Qualifications, and Advancement

Most darkroom technicians learn their skills through informal on-the-job training. Beginners start as helpers, and gradually learn to

develop and print film by assisting experienced technicians. It generally takes 3 to 4 years to become a fully qualified darkroom technician. Some helpers become specialists in a particular activity, such as printing or developing. Generally, the training time required in order to become a specialist is less than is needed to become an all-round darkroom technician.

When hiring darkroom technician helpers, employers prefer applicants who have high school educations. Courses in chemistry and mathematics are helpful to young people interested in this trade. Some high school and trade schools offer courses in photography that include training in film processing. The Armed Forces also offer training for darkroom technicians. Experience gained through processing film as a hobby is helpful.

Two-year curricula leading to an associate degree in photographic technology are offered by a few colleges. Completion of college level courses in this field is helpful to people who are interested in supervisory and managerial jobs in photo labs.

Many darkroom technicians eventually become professional photographers. (See Statement on photographers elsewhere in the *Handbook*.) Others advance to supervisory positions in laboratories.

Training requirements for workers in semiskilled photolab occupations range from a few weeks to several months of on-the-job training. For example, film numberers and slide mounters usually can learn their jobs in less than a month, but printer operators and chemical mixers need several months or longer. For many semiskilled jobs, manual dexterity, good vision including normal color perception, and good hand-eye coordination are important qualifications. However, some laboratories employ blind workers as film numberers and film strippers, since these jobs are performed in the dark to prevent damage to exposed film. Completion of high school generally is not required for semiskilled jobs, but frequently is needed for advancement to supervisory jobs.

Employment Outlook

Employment in photo lab occupations is expected to increase rapidly through the mid-1980's. In addition to jobs resulting from employment growth, many openings will result from the need to replace experienced workers who retire, die, or transfer to other fields of work.

The need for semiskilled workers is tied closely to the growth of amateur photography. Film purchases by amateur photographers are expected to increase very rapidly as a result of rising population and personal income, more leisure time, and increased travel. Improvements in still and movie cameras that make them easier to load and operate also should contribute to increases in the use of film. However, the use of mechanized film processing equipment will increase the efficiency of laboratory workers, and will keep employment from growing as fast as the amount of film processed.

The need for all-round darkroom technicians is expected to increase as a result of the growing demand for photography in business and government. A major factor contributing to this demand will be the increasing variety of printed matter that is illustrated with photographs. The growing use of photography in research and development activities also will contribute to the demand for darkroom technicians.

Earnings and Working Conditions

Earnings of photo lab workers vary greatly and depend on factors such as skill level, experience, and geographic location. Beginning pay for inexperienced darkroom technicians' helpers ranged from $2.25 to $3.50 an hour in 1972, according to the limited information available. Most of the experienced all-round darkroom technicians earned between $3.00 and $5.50 an hour.

Workers in semiskilled occupations earned from $2.25 to $3.75 an hour. Among these workers, printer operators and chemical mixers generally had the highest earnings.

Many photo labs provide paid holidays, vacations, and other benefits, such as health and life insurance. Workers in labs operated by business and government organizations receive the same fringe benefits as their fellow employees.

The majority of photo lab employees have a 40-hour workweek and get premium pay for overtime. In labs that specialize in processing film for amateur photographers, employees may work a considerable amount of overtime during the summer and for several weeks after Christmas. Many labs employ additional workers temporarily during these seasonal peaks.

Photo lab jobs are not physically strenuous. In many semiskilled occupations, workers perform their jobs while sitting, but the work is repetitious and the pace is rapid. Some workers (for example, printer operators and photocheckers and assemblers) are subject to eye fatigue. Photofinishing labs are generally clean, well-lighted, and air-conditioned.

Sources of Additional Information

Information about employment opportunities in photographic laboratories and schools that offer degrees in photographic technology

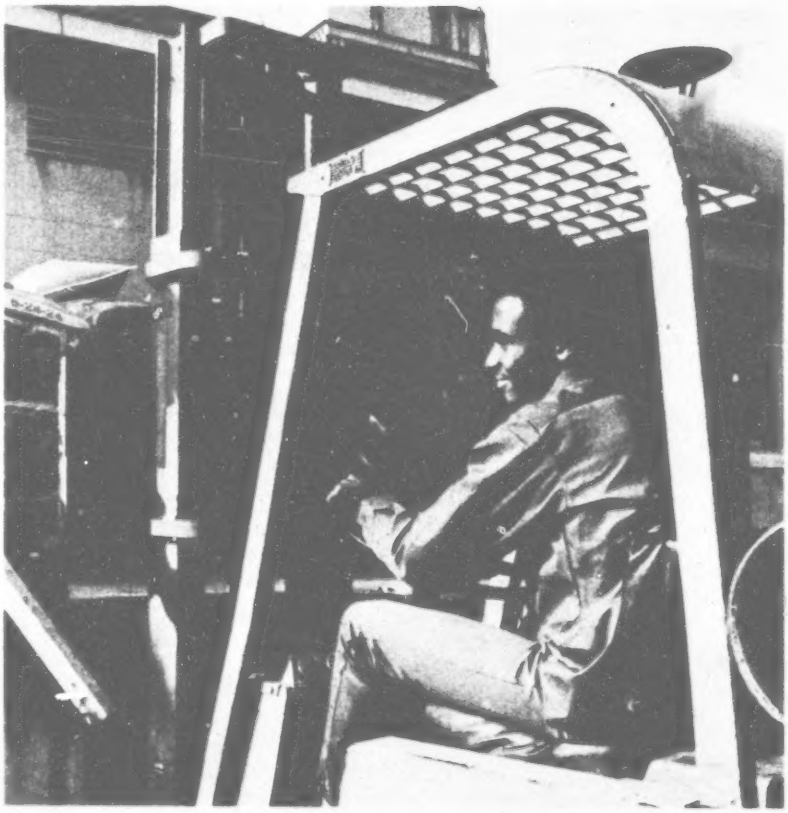
is available from:

Master Photo Dealers' and Finishers' Association, 603 Lansing Ave., Jackson, Mich. 49202.

Professional Photographers of America, Inc., 1090 Executive Way, Des Plaines, Ill. 60018.

POWER TRUCK OPERATORS

(D.O.T. 922.782 and .883)



Nature of the Work

In the past, manual workers usually did the hard physical labor of moving raw materials and products. Today, many heavy materials are moved by workers who operate various types of self-powered trucks. A typical truck has a hydraulic or electric lifting mechanism and special attachments for use on particular jobs. For example, a truck may have a fork lift to move piles of cartons, a scoop to lift coal, or a tow bar to pull small trailers.

Operators must use care and skill in driving trucks. For example, when loading or removing materials from stock, which may be stacked from floor to ceiling, they must be able to judge distance so that no damage occurs. They also must know how much the truck can lift and carry and the kinds of jobs it can do.

Operators may have to keep records of materials moved and do some manual loading and unloading. They also may be responsible for keeping their trucks in good working condition by cleaning, oiling, checking the water in batteries, and making simple adjustments.

Places of Employment

About 300,000 power truck operators were employed in 1972. Power truck operators worked in all types of manufacturing industries. Large numbers were employed in plants that made automobiles, machinery, fabricated metal products, and iron and steel. Many power truck operators also were employed in warehouses, depots, dock terminals, and mines.

Because power truck operators are employed in many different industries, they work in all parts of the country. Although some are employed in small towns, most work in heavily populated areas where large factories are located.

Training, Other Qualifications, and Advancement

Most workers can learn to operate a power truck in a few days. It takes several weeks, however, to learn the layout and operation of a plant and the most efficient way of handling materials.

Large companies generally require applicants to pass a physical examination. Many large companies have formal training programs to teach new employees to operate power trucks, make simple repairs, and handle materials. They also learn plant layout and operation and safe driving rules.

Young persons who are planning to become power truck operators should have manual dexterity, mechanical ability, and above-average eyesight, including good depth perception.

Opportunities for advancement are limited. A few operators may

become material-movement foremen or supervisors.

Employment Outlook

Employment of power truck operators is expected to increase moderately through the mid-1980's. In addition to jobs resulting from employment growth, many openings will result from the need to replace workers who retire, die, or transfer to other occupations.

More goods will be manufactured as population grows and our standard of living rises. Power truck operators will be needed to move these goods and the materials used to produce them. Employment growth will be limited, however, by the development of more efficient trucks and other mechanized material-handling equipment.

Earnings and Working Conditions

According to a survey of metropolitan areas in 1971-72, power truck operators in manufacturing earned an average of $3.50 an hour, about the same as the average for nonsupervisory workers in all private industries except farming. Earnings of operators varied by region, as shown below:

Area	*Hourly rate*
United States	$3.50
Northeast	3.37
South	3.00
North Central	3.73
West	3.67

Power truck operators are subject to hazards such as falling objects and collisions between vehicles. They may operate their trucks outdoors where they are exposed to all kinds of weather. Some operators may handle loose material that is dirty or dusty. Moving materials throughout a plant, however, is likely to be less routine and boring than many other production jobs.

Many power truck operators are members of labor unions. Most union contracts in manufacturing plants provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Sources of Additional Information

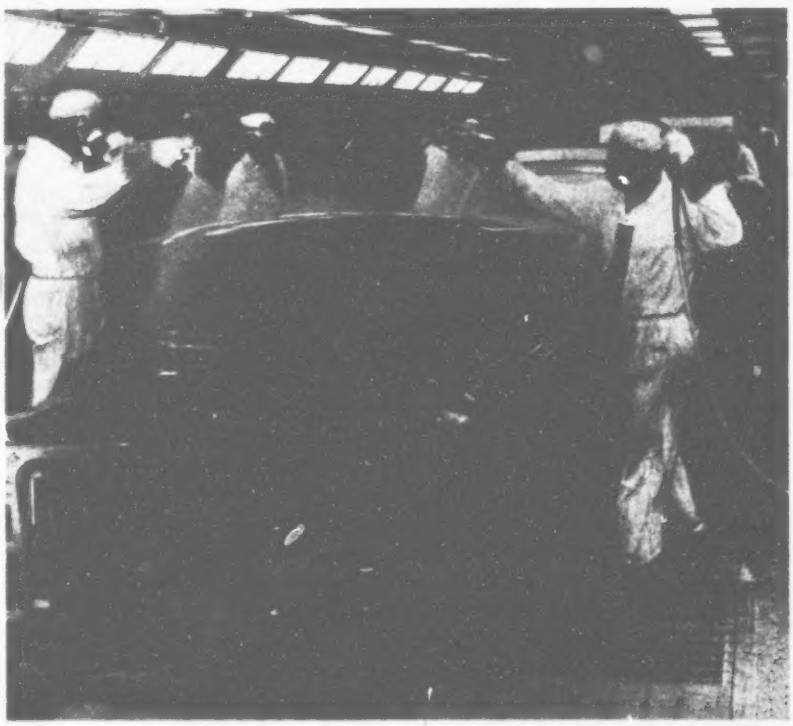
Information on work opportunities for power truck operators may be available from the local office of the State employment service.

PRODUCTION PAINTERS

Nature of the Work

Almost every metal or wood product manufactured gets a coating of paint or other protection. In mass-production, most painters use sprayguns to apply paint, lacquer, varnish, and other finishes; some use brushes; and others operate spraying machines, dipping tanks, or tumbling barrels. The work of production painters in factories is different from that of skilled painters in construction and maintenance work. (See statements on painters and automobile painters elsewhere in the *Handbook*.)

Production painters may have to clean items before painting them. On multicolored items they use masking tape to keep colors from overlapping. Spraygun operators adjust spraygun nozzles and other controls so the paint will be applied evenly. Some operate special sprayguns such as those used to apply powdered plastics. Painting machine operators may load items into the machine or



Production painters apply acrylic enamel to automobile body.

onto conveyors before applying paint.

Most production painters do simple, repetitive work; others have to decide finishes, paint thinning, and the adjustment of spray equipment. Mixing paints and figuring areas to be painted require simple arithmetic involving decimals and fractions.

Production painters may replace nozzles and clean sprayguns and other equipment. Besides the painting equipment, they use wrenches, mixing paddles, and gages which show the consistency of paint.

Places of Employment

About 180,000 production painters were employed in 1972; most of whom were men. More than four-fifths of the total worked in plants that manufactured furniture, automobiles, household appliances, industrial machinery, and other durable goods. Large numbers of production painters were employed in New York, Michigan, Ohio, California, Illinois, Pennsylvania, Texas, North Carolina, and New Jersey.

Training, Other Qualifications, and Advancement

The new worker usually learns by watching and helping experienced production painters. The length of training may vary from a few days to several months.

Production painters should have a steady hand, the ability to stand for long periods, and good eyesight to distinguish between colors and to apply paint evenly. High school graduation generally is not required.

Opportunities for advancement are limited. A small number of production painters become inspectors and foremen.

Employment Outlook

Employment of production painters is expected to increase slowly through the mid-1980's. Most job openings will result as experienced workers retire, die, or transfer to other occupations.

Most manufacturing industries which employ production painters are expected to increase their output in the years ahead. Demand for consumer products, such as automobiles and furniture, will increase as population and personal income grow. Business growth will create a need for more industrial machinery and equipment. Employment of painters, however, is not expected to keep pace with manufacturing output because the greater use of automatic sprayers and other labor-saving innovations, such as powder coating applied by electrostatic guns, should raise output per worker.

Earnings and Working Conditions

Hourly wage rates for production painters ranged from about $2.30 to $4.60 in 1972, based on information from a limited number of union contracts. Most contracts provided for holiday and vacation pay, health insurance, life insurance, and retirement pensions.

Painters are exposed to fumes from paint and paint-mixing ingredients. Some wear protective clothing and masks which cover the nose and mouth. When painting large objects, they sometimes work in awkward and cramped positions.

Among unions organizing production painters are the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Furniture Workers of America; and the United Steelworkers of America.

Sources of Additional Information

More facts about job opportunities in this field may be available from local offices of the State employment service.

STATIONARY ENGINEERS

(D.O.T. 950.782)

Nature of the Work

Stationary engineers operate and maintain boilers, diesel engines, turbines, generators, pumps, and compressors. The equipment is used to generate power and to control the temperature and humidity in factories and other buildings. Stationary engineers must operate and maintain the equipment according to State and local laws, since the safety of many people depends upon its proper functioning.

Stationary engineers detect and identify any trouble that develops by watching and listening to machinery, and by analyzing readings of meters, gages, and other instruments. They operate levers, throttles, switches, valves, and other devices to regulate the machinery, and also record such information as fuel consumption and boiler temperatures and pressure. Stationary engineers use handtools to repair equipment. Common repairs involve reseating valves and replacing gaskets, pumps, and bearings.

In a large plant, the stationary engineer may have charge of the boiler room, and direct the work of assistant stationary engineers, turbine operators, boiler operators, and air-conditioning and refrigeration mechanics. In a small plant, the stationary engineer may operate and maintain equipment by himself.

Places of Employment

In 1972, about 175,000 stationary

engineers were employed in a wide variety of places, including power stations, factories, sewage and water-treatment plants, office and apartment buildings, hotels, and hospitals. Federal, State, and local governments also employed large numbers of these workers. Most plants which operate on three shifts employ four to eight stationary engineers, but some have more. In many plants, only one engineer works on each shift.

Because stationary engineers work in so many different kinds of industries, they are employed in all parts of the country. Although some are employed in small towns and in rural areas, most work in the more heavily populated areas where large industrial and commercial businesses are located.

Training, Other Qualifications, and Advancement

Many stationary engineers start as helpers or craftsmen in other trades and acquire their skills through informal on-the-job experience. However, most training authorities recommend formal apprenticeship programs because of the increasing complexity of the machines and systems.

In selecting apprentices, most joint labor-management apprenticeship committees prefer high school or trade school graduates between 18 and 25 years of age who have received instruction in mathematics, mechanical drawing, machine-shop practice, physics, and chemistry. Mechanical aptitude, manual dexterity, and good physical condition also are important qualifications.

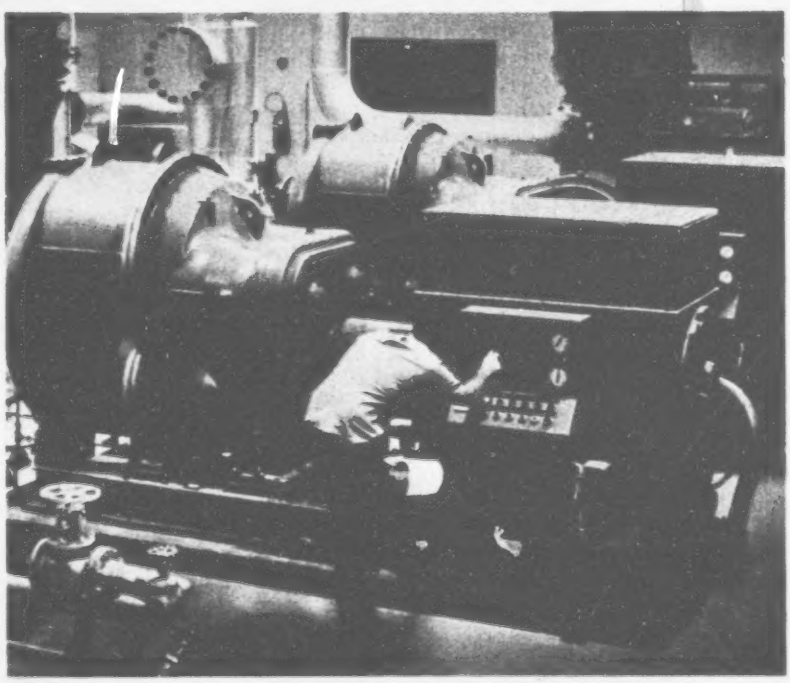
The apprenticeship usually lasts 3 to 4 years. In addition to on-the-job training apprentices receive classroom instruction in practical chemistry, elementary physics, blueprint reading, applied electricity, and other technical subjects.

Becoming a stationary engineer without going through a formal apprenticeship program usually takes many years of experience as an assistant to licensed stationary engineers. This practical experience usually is supplemented by technical or other school training or home study.

Some States, the District of Columbia, and many large and medium-size cities have licensing requirements for stationary engineers. Although requirements for a license differ from place to place, the following are typical: applicants must be over 21 years of age; they must reside for a specified period in the State or locality in which the examination is given; and they must meet the experience requirements for the class of license requested and pass an examination which may be written, oral, or both.

Generally, there are several classes of stationary engineer licenses which specify the steam pressure or horsepower of the equipment the engineer can operate. The first-class license permits the stationary engineer to operate equipment of all types and capacities. The lower class licenses limit the capacity of the equipment the engineer may operate without the supervision of a higher rated engineer.

Stationary engineers advance to more responsible jobs by being placed in charge of larger, more powerful, or more varied equipment. Generally, engineers advance to these jobs as they obtain higher grade licenses. Advancement, however, is not automatic. For example, an engineer who has a first-class license may work for some time as an assistant to another first-class engineer before a vacancy occurs. Some stationary engineers eventual-



Stationary engineer operates compressor.

ly advance to jobs as plant engineers and as building and plant superintendents.

Employment Outlook

Employment of stationary engineers is expected to show little or no change through the mid-1980's. Nevertheless, several thousand job openings will arise annually because of the need to replace experienced workers who retire, die, or transfer to other occupations.

Industrial growth will result in an increased use of large boilers and auxiliary equipment in factories, powerplants, and other buildings. The need for additional stationary engineers, however, will be limited by the trend to more powerful and more centralized equipment with automatic controls. For example, large boilers make it possible to increase capacity without corresponding increases in the number of stationary engineers. In a growing number of plants, centralized control panels and closed circuit television monitoring systems will reduce the need for on-site observation of equipment. Automatic control systems which regulate throttles, valves, and other devices previously regulated by hand, also will increase the efficiency of stationary engineers.

Earnings and Working Conditions

Stationary engineers had average hourly earnings of $4.14 in 1971-72, according to a survey of metropolitan areas. This was higher than the average for all nonsupervisory workers in private industry, except farming. Averages for engineers in individual areas ranged from $4.29 in the south to $5.21 in the western United States.

Stationary engineers generally have steady year-round employment. They usually work a 5-day, 40-hour week. In plants that operate around the clock, they may be assigned to any one of three shifts—often on a rotating basis—and to Sunday and holiday work. Many employers provide finge benefits such as health insurance, life insurance, and retirement pensions.

Engine rooms, powerplants, or boiler rooms usually are clean and well-lighted. Even under the most favorable conditions, however, some stationary engineers are exposed to high temperatures, dust, dirt, contact with oil and grease, and fumes or smoke. They may have to crawl inside boilers and work in crouching or kneeling positions to inspect, clean or repair the interiors.

Because stationary engineers often work around boilers and electrical and mechanical equipment, they must be alert to avoid burns, electric shock and injury from moving machinery.

Among the unions to which these workers belong are the International Union of Operating Engineers and the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

Information about training or work opportunities may be obtained from local offices of State employment services, locals of the International Union of Operating Engineers, and from State and local licensing agencies.

Specific questions about the occupation may be referred to:

International Union of Operating Engineers, 1125 17th St. NW., Washington, D.C. 20036.

National Association of Power Engineers, Inc. 176 West Adam St., Chicago, Ill. 60603.

STATIONARY FIREMEN (BOILER)

(D.O.T. 951.885)

Nature of the Work

Stationary firemen operate and maintain the steam boilers that power industrial machinery and heat factories, offices, and other buildings. Qualified firemen may be responsible for inspecting boiler equipment, lighting boilers, and maintaining steam pressure.

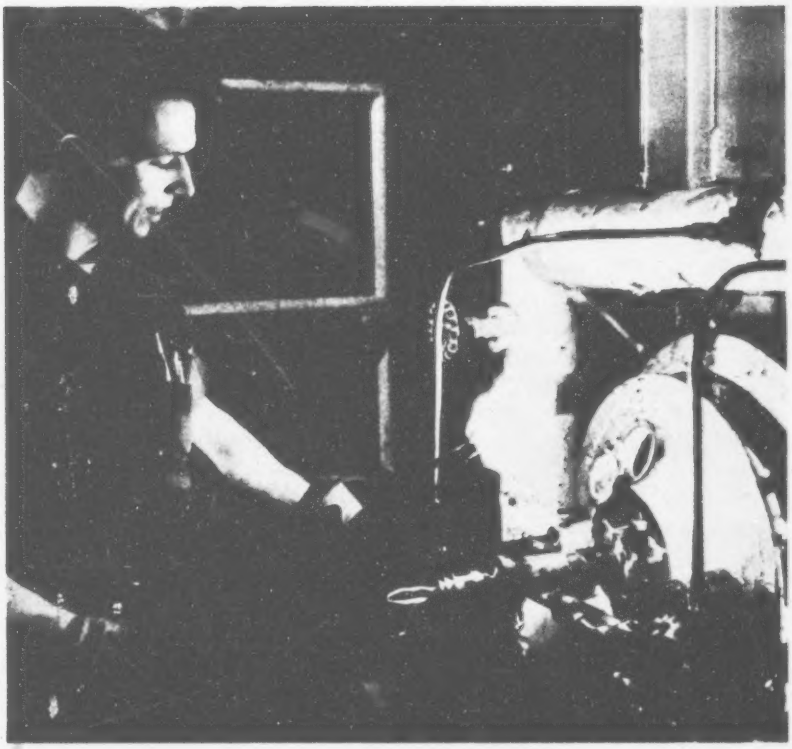
In most plants, stationary firemen operate mechanical devices that control the flow of air, gas, oil, or coal into fireboxes. They read meters and other instruments to make sure boilers are operating according to safety regulations. They sometimes make minor repairs, and test and treat boiler water with chemicals. They may also operate waste heat boilers.

Stationary firemen often are supervised by stationary engineers who operate and maintain a variety of equipment, including boilers, diesel and steam engines, and refrigeration and air-conditioning systems. (Additional information on stationary engineers appears elsewhere in the *Handbook*.)

Places of Employment

Most of the 93,000 stationary firemen employed in 1972 worked in manufacturing industries. Plants that manufacture lumber, iron and steel, paper, chemicals, and transportation equipment are among the leading employers of stationary firemen. Public utilities also employ many of these workers.

Although stationary firemen are employed in all parts of the country, most work in the more heavily populated areas where large manufacturing plants are located.



Stationary fireman lights boiler.

Training, Other Qualifications, and Advancement

Some large cities and a few States require stationary firemen to be licensed. An applicant can obtain the knowledge and experience to pass the license examination by first working as a helper in a boiler room.

License requirements differ from city to city and from State to State. However, applicants usually must meet experience requirements and pass an examination to obtain a license. For specific information about licensing, State and local authorities should be consulted.

There are two types of stationary firemen licenses—for low and high pressure boilers. Low pressure firemen operate boilers generally used for heating buildings. High pressure firemen operate the more powerful boilers and auxiliary boiler equipment used to power machinery as well as heat large buildings. Both high and low pressure firemen, however, may operate equipment of any pressure if a stationary engineer is on duty.

Stationary firemen should understand the operation of machinery, and must have normal vision and good hearing. Because of the mechanization of equipment, physical strength is no longer a major requirement for this type of work.

Stationary firemen may advance to stationary engineers. To help them advance, firemen sometimes supplement their on-the-job training by taking courses in chemistry, physics, blueprint reading; electricity, and air conditioning and refrigeration. Stationary firemen also may become maintenance mechanics.

Employment Outlook

Employment of stationary firemen is expected to decline slowly through the mid-1980's. Hundreds of job openings, however, will result each year from the need to replace experienced firemen who transfer to other occupations, retire, or die.

Although an increase in the use of boilers and auxiliary equipment is expected, the trend to automatic, more powerful, and more centralized equipment is expected to result in a decline in employment of stationary firemen. In large plants, however, where turbines and engines are housed under a separate roof, and where there is a need for constant surveillance of boilers, firemen will continue to be needed.

Earnings and Working Conditions

Stationary firemen had average hourly earnings of $3.74 according to a survey of metropolitan areas in 1971-72. This was the average for all nonsupervisory workers in private industry, except farming. Average for firemen in individual areas ranged from $2.25 in Greenville, S.C. to $5.44 in Detroit, Mich.

Many stationary firemen received paid holidays and vacations, and other benefits such as health insurance, life insurance, and retirement pensions.

Stationary firemen may have to work in awkward positions and be exposed to noise, heat, grease, fumes, and smoke. They are subject also to burns, falls, and injury from moving machinery. Defective boilers and auxiliary equipment may be dangerous to firemen and other persons. Modern equipment and safety procedures, however, have reduced accidents.

The principal unions organizing

stationary engineers are the International Brotherhood of Firemen and Oilers and the International Union of Operating Engineers.

Sources of Additional Information

Information about training or work opportunities in this trade may be obtained from local offices of State employment services, locals of the International Brotherhood of Firemen and Oilers, and from State and local licensing agencies.

Specific questions about the nature of the occupation, training, and employment opportunities may be referred to:

International Brotherhood of Firemen and Oilers, 200 Maryland Ave. NE., Washington, D.C. 20002.

WASTEWATER TREATMENT PLANT OPERATORS (Sewage-Plant Operator)

(D.O.T. 955.782)

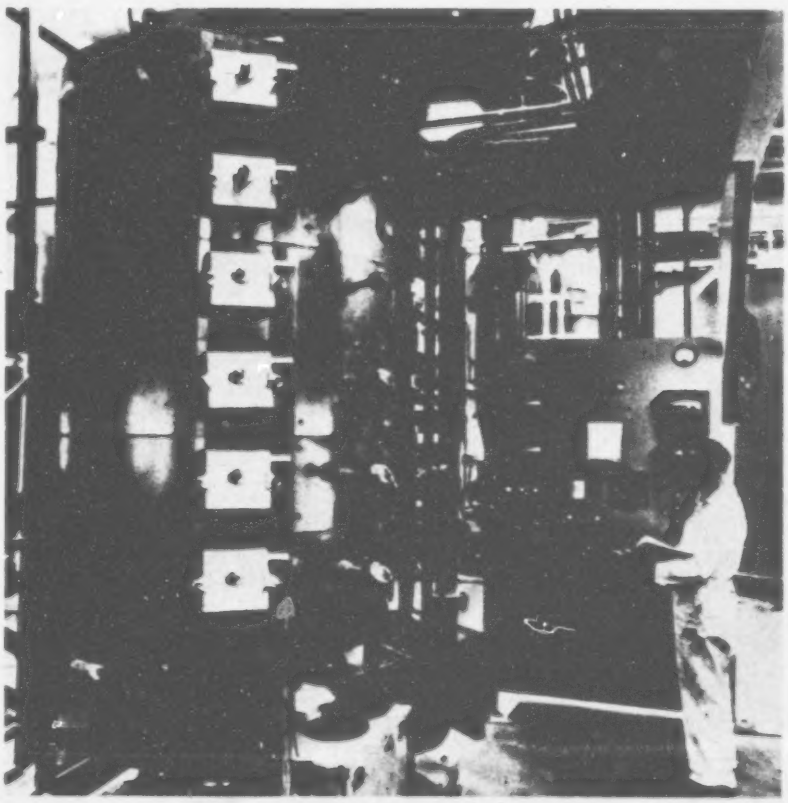
Nature of the Work

Clean water is essential for our health and recreation and for the existence of fish and wildlife. Wastewater treatment plant operators help keep America's water clean by removing harmful domestic and industrial waste.

Waste materials are carried by water through sewer pipes to treatment plants. Wastewater treatment plant operators control equipment to remove these materials or render them harmless. By operating and maintaining pumps, pipes, and valves that connect the collection system to the treatment facility, operators move the wastewater through the various treatment processes.

Operators read meters and gauges to make sure plant equipment is working properly. Other jobs include operating screening devices to remove solids from wastewater; taking samples of the water for laboratory analysis; and testing and adjusting the level of chlorine in the water. Operators also make minor repairs on valves, pumps, and other equipment. They use wrenches, pliers, and other common hand tools, as well as special tools. Occasionally operators must work under emergency conditions—for example, a heavy rainstorm may cause abnormal amounts of wastewater to flow into sewer pipes and threaten to exceed a plant's treatment capacity.

The duties of operators vary depending on the type and size of plant. The treatment process in an industrial plant, such as a food-processing company for example, may be simple since the wastewater is of a known content. Treatment plants which serve entire cities, on the other hand, must be equipped to treat a mixture of waste products that varies daily, thus making the operator's job more complicated. In smaller plants, one operator may be responsible for the entire system—making repairs, keeping plant records, handling complaints, and doing the maintenance work for the facility. In larger plants, the staff may include chemists, laboratory technicians, mechanics, helpers, foremen, and a superintendent.



Treatment plant operator records instrument reading.

Places of Employment

About 20,000 people worked full-time as wastewater treatment plant operators in 1972, of whom 14,500 worked in municipal plants, 4,500 in private industry, and 1,000 in Federal installations.

Wastewater treatment plant operators are employed throughout the country. Geographically, employment is distributed much like the Nation's population, with most jobs in larger towns and cities. Many operators in small towns are employed part-time.

Training, Other Qualifications, and Advancement

Trainees usually start as helpers and learn their skills on the job under the direction of an experienced operator. They learn by helping in routine tasks, such as recording meter readings; taking samples of wastewater and sludge; and doing simple maintenance and repair work on pumps, electric motors, and valves. They also are expected to perform housekeeping tasks such as cleaning and maintaining plant equipment and property.

Young people who are interested in entering the field should have some mechanical aptitude, and should be competent in basic mathematics. Employers generally prefer trainees who have a high school diploma or its equivalent, and in some States this is a minimum educational requirement. Some positions, particularly in larger cities and towns, are covered by civil service regulations, and applicants may be required to pass written examinations testing elementary mathematics, mechanical aptitude, and general intelligence. Operators must be agile, since they have to climb ladders and move easily around heavy machinery.

Some two-year programs leading to an associate degree in wastewater technology are available that provide a good general knowledge of the water pollution control field as well as basic preparation for becoming an operator. Since plants are becoming more complex, completion of such courses increase an applicant's chances for employment and promotion. Programs also are available under provisions of the Manpower Development and Training Act. Trainees who have completed such programs may bypass much of the basic on-the-job training and advance more rapidly.

Most State water pollution control agencies offer training courses to improve the skills of treatment plant operators. These courses cover principles of sludge digestion, odors and their control, chlorination, sedimentation, biological oxidation, and flow measurements. Some operators take correspondence courses on subjects related to wastewater treatment, and some municipalities will pay part of the tuition for courses leading to a college degree in science or engineering.

Operators may be promoted to supervisory positions such as foreman and superintendent. Superintendents of large and complex plants are expected to have an engineering or science degree. A high school diploma and increasingly responsible experience may be sufficient to qualify as superintendent of a small or medium-sized plant at present, but educational requirements are rising as more complex treatment plants are built to meet new water pollution control standards. A limited number of operators may become technicians employed by State water pollution control agencies to monitor and provide technical assistance to plants throughout the State. Some technical-vocational school or junior college training is generally preferred for technician jobs.

In 35 States, supervisors and certain operators must pass an examination to certify that they are capable of overseeing treatment plant operations. Voluntary certification programs are in effect in the remaining States, with the exception of Alaska and Mississippi.

Under a typical program, there are different classes of certification for different sizes of treatment plants. For example, to be certified a Class I operator (corresponding to a Class I plant serving a population of less than 2,000), an applicant may be required to be a high school graduate, demonstrate general knowledge of treatment operations by passing a written test, and have completed 1 year of employment at a treatment plant. Requirements for certification as a Class IV operator (corresponding to a Class IV plant, serving a population in excess of 40,000) may be completion of 2 or more years of college in science and engineering; 5 years of treatment plant experience at a Class III plant or higher, 2 years of which were in a position of major responsibility; and specific knowledge of the entire field of wastewater treatment as demonstrated through a written test.

Employment Outlook

Employment of wastewater treatment plant operators is expected to rise rapidly through the mid-1980's, mainly as a result of the construction of new treatment plants to process the increasing amount of domestic and industrial wastewater. Also, more highly trained operators will be needed as existing plants expand and modernize their facilities to cope more effectively with water pollution. In addition to the new jobs from employment growth, many job openings will occur as experienced

operators retire, die, or transfer to other occupations.

Earnings and Working Conditions

Earnings of operators ranged from about $5,000 to $14,000 a year in 1972, based on information from a survey covering a number of cities throughout the United States. Operators at the supervisory level could earn even more. Salaries for trainees were roughly 80 percent of operators' salaries in most cities.

Fringe benefits for operators usually are similar to those received by other local government employees. Typically, they receive paid vacations and holidays, overtime, shift differential pay, sick leave, paid hospitalization and life insurance, and retirement benefits.

Because pollution control is a never ending task, operators work different shifts and in an emergency may have to work overtime. Operators may be exposed to unpleasant odors, as well as noise from the operation of electrical motors and pumps. However, odor is kept to a minimum by the use of chlorine or other chemicals.

Sources of Additional Information

Young people interested in a career in wastewater treatment should contact their local or State water pollution control agencies. Additional information may be obtained from:

Water Pollution Control Federation, 3900 Wisconsin Ave. NW., Washington, D.C. 20016

Environmental Protection Agency, Office of Water Programs Operations Manpower Development Staff, 401 M St. SW., Washington, D.C. 20460.

WELDERS AND FLAME CUTTERS

(D.O.T. 810. through 819.887)

Nature of the Work

Welding is one of the most common means of joining metal parts. Many of the parts in automobiles, spacecraft, airplanes, household appliances, and thousands of other products are joined by this process. Structural metal used for bridges and buildings is often welded. Most of the 40 or more different welding processes fall under three basic categories: arc, gas, and resistance welding. Arc and gas welding can be performed manually or by machine. Resistance welding is mainly a machine process.

Manual welders may do arc or gas welding, or both, and they may be either skilled or semiskilled. Skilled welders are able to plan and lay out work from drawings, blueprints, or other written specifications. They know the welding properties of steel, bronze, aluminum, and other metals and alloys. They also can weld all types of joints held in various positions (flat, vertical, horizontal, and overhead). Semiskilled manual welders usually do repetitive work; that is, production work which generally does not involve critical safety and strength requirements. They primarily weld surfaces in only one position.

Manual welders control the melting of metal edges by directing heat to the edges, either from an electric arc or from a gas-welding torch. In one of the most common arc welding processes, they first "strike" an arc (create an electric circuit) by touching the metal with the electrode. They guide the electrode at a suitable distance from the edges, and intense heat caused by the arc melts the edges and the electrode tip. The molten metal solidifies to form a solid connection.

Welders use special masks and heavy gloves to prevent injuries.

Gas welders apply an intensely hot flame to the metal edges. After the torch is lighted, valves are adjusted to obtain the proper flame for the particular job. Gas welders heat the metal with the torch and apply a welding rod to the molten metal to supply additional filler for the joint.

In production processes, especially where the work is repetitive and the items to be welded are relatively uniform, the welding may be done by semiskilled workers who operate machines. For example, *resistance welding operators* (D.O.T. 813.885) feed and aline the work and remove it after the welding operation is completed. Occasionally, they may adjust the controls of the machine for the desired electric current and pressure.

Closely related to manual welders are *oxygen cutters* (D.O.T. 816.782 and .884) and *arc cutters* (D.O.T. 816.884). These workers cut or trim

metals. Oxygen cutters melt the metal with a gas torch and cut it by releasing a stream of oxygen from the torch. Arc cutting differs from oxygen cutting because an electric arc is the source of heat. Oxygen and arc cutters also may operate a torch mounted on an electrically- or mechanically-controlled machine which automatically follows the proper guideline.

Places of Employment

About 555,000 welders and flame cutters were employed throughout the country in 1972. Very few were women. About three-fifths of the total were employed by firms that manufactured durable goods, such as transportation equipment, machinery, and primary metals. Most of the rest worked for construction firms and repair shops.

The widespread use of the welding and cutting processes enables these workers to find jobs in every State. Most of the jobs, however, are found in the major metalworking areas. In 1972, about half of all welders and cutters were employed in seven States—Pennsylvania, California, Ohio, Michigan, Illinois, Texas, and New York.

Training, Other Qualifications, and Advancement

Generally, it takes several years of training to become a skilled manual arc or gas welder, and somewhat longer to become a combination welder (both arc and gas welding). Some of the less skilled jobs, however, can be learned in a few months of on-the-job training.

Training requirements for resistance-welding machine operators depend upon the particular type of equipment used; most of them learn their work in a few weeks. Little skill is required for most oxygen and arc-cutting jobs; generally, they also can be learned in a few weeks.

Young persons planning careers as welders or cutters need manual dexterity, good eyesight, and good eye-hand coordination. They should be able to concentrate on detailed work for long periods, and must be free of any physical disabilities that would prevent them from bending, stooping, and working in awkward positions.

For entry into manual welding jobs most employers prefer applicants who have high school or vocational school training in welding. Courses in mathematics, mechanical drawing, and blueprint reading also are helpful.

Beginners often start in simple production jobs where the type and thickness of metal, as well as the position of the welding operation, rarely change. Occasionally, they are first given jobs as cutters and later move up to manual welding.

A few large companies offer welder apprenticeship programs that run as long as 8,000 hours. Also, the U.S. Department of the Navy, at several of its installations, conducts 4-year welder apprenticeship programs for its civilian employees.

Programs to train unemployed and underemployed workers for entry level welding jobs or to upgrade welding skills were operating in many cities in 1972 under the Manpower Development and Training Act and other legislation. The training, which may be in the classroom or on the job, lasts from several weeks up to 1 year. Additional work experience and on-the-job training may qualify graduates as skilled welders in a relatively short time.

Before being assigned to work on boilers or other jobs where the strength of the weld is highly critical, welders may be required to pass an examination given by an employer or government agency. New developments in some manufacturing industries are increasing the skills required of welders. This is particularly true in fields such as atomic energy or missile manufacture, which have high standards for the reliability of welds and require more precise work.

Welders may be promoted to jobs as welding inspectors, technicians, or foremen. A small number of experienced welders open their own welding and repair shops.

Employment Outlook

Employment of welders is expected to increase rapidly through the mid-1980's as a result of the generally favorable longrun outlook for metalworking industries and the wider use of the welding process. In addition to jobs created by employment growth, a few thousand openings will arise annually because of the need to replace experienced workers who retire or die. Openings will occur, also, as some welders transfer to other occupations.

Many more manual welders will be needed for maintenance and repair work in the growing metalworking industries. The number of manual welders in production work is expected to increase in plants that manufacture ships, boilers, storage tanks, and other structural-metal products. The construction industry will need an increasing number of welders as the use of welded steel building techniques expands.

Employment prospects for resistance welders are expected to continue to be favorable because of the increased use of machine resistance-welding in the manufacture of motor vehicles, aircraft and missiles, railroad cars, and other products.

The number of jobs for oxygen and arc cutters is expected to rise somewhat during the years ahead as the result of the general expansion of

metalworking activity. The increased use of oxygen and arc-cutting machines, however, will tend to restrict growth in these occupations.

Earnings and Working Conditions

National wage data on welders and cutters are not available. However, data from several union contracts in the shipbuilding and fabricated structural metal products industries indicate that welders hourly earnings ranged from $3.85 to $4.90 in 1972. Cutters generally earn less than welders.

The standard workweek for welders and cutters is 40 hours. Many employers provide paid vacations and holidays, and additional benefits, such as life and health insurance, and retirement pensions.

Welders and cutters use protective clothing, goggles, helmets with protective lenses, and other devices to prevent burns and eye injuries. Although lighting and ventilation are usually adequate, they occasionally work in the presence of toxic gases and fumes caused by the melting of some metals. They are often in contact with rust, grease, paint, and other elements on metal surfaces. Operators of resistance-welding machines are largely free from the hazards associated with hand welding. An eyeshield or goggles generally offer adequate protection to these workers.

Many welders and cutters are union members. Among the unions that organize these workers are the International Association of Machinists and Aerospace Workers; the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; and the United Electrical, Radio and Machine Workers of America (Ind.). Only one labor organization—the International Union, United Welders (Ind.), is known to be composed entirely of welders, employed largely in the aircraft industry on the west coast.

Sources of Additional Information

For further information on training and work opportunities for welders and flame cutters, contact local employers. Local offices of the State employment service also may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. General information about welders may be obtained from the State Supervisor of Trade and Industrial Education or the local Director of Vocational Education in the State or city in which a person wishes to receive training or by writing to:

The American Welding Society, 2501 NW. 7th St., Miami, Fla. 33125.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

OFFICE OCCUPATIONS

Office workers perform a wide range of tasks that are needed to keep business and other organizations running on a day to day basis. Clerical workers, such as secretaries and typists, maintain files, type, and operate office machines. Professional and technical employees, on the other hand, give legal advice, prepare and analyze financial reports, design computer systems, and arrange bank loans.

Opportunities in office work exist for people with widely different educational backgrounds. Some jobs can be entered with only a high school education; many others, however, require at least a college degree.

Many clerical employees work with things and often do detailed, repetitive tasks. Most professional office workers, on the other hand, work with ideas; they apply their skills to solving problems and devising ways to provide better services to those who depend on them. Besides the technical skills required to do their jobs, office workers need judgment and the ability to communicate their ideas to others.

This chapter of the *Handbook* describes office work in Clerical Occupations, Computer and Related Occupations, Banking Occupations, Insurance Occupations, and Administrative and Related Occupations.

CLERICAL OCCUPATIONS

More than 14 million people worked in clerical jobs in 1972. Many keep records and do other office paperwork. Others handle communications, operate office machines, ship and receive merchandise, and ring sales on cash registers.

Workers in clerical jobs have a wide variety of skills and experience. They include highly skilled title searchers in real estate firms and executive secretaries in business offices as well as relatively unskilled messengers and file clerks.

More than one out of five clerical employees work as secretaries or stenographers. Bookkeepers and accounting clerks, representing a little more than one-tenth of the total, make up the next largest group. Chart 12—shows employment in these and other major clerical occupations discussed in the *Handbook*.

Training, Other Qualifications, and Advancement

Clerical workers need high school diplomas for all but the most routine jobs, and many employers prefer applicants who have had business courses. Some companies cooperate with local high schools and business schools in office education programs that enable students to work part time while attending school. This experience is helpful for beginners seeking jobs after graduation. The Federal Government also sponsors training for some clerical occupations under provisions of the Manpower Development and Training Act and other legislation.

Beginning clerical workers often receive on-the-job training. They learn how their employers keep records and the kinds of business forms used. They also may learn to operate adding and duplicating machines and other office equipment. They may attend school to learn how to operate tabulating machines and other specialized equipment. Secretaries and typists need special skills that must be learned in schools or formal training programs.

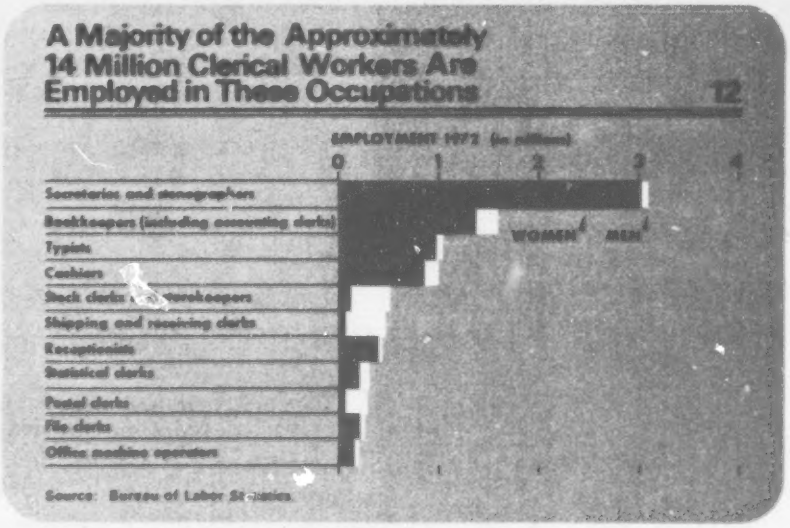
Many clerical jobs require reading comprehension, a knowledge of spelling and grammar, and arithmetic skills. Some employers test applicants for clerical aptitude.

Advancement opportunities for many clerical workers are good and organizations often provide courses so that employees can get the skills needed. As workers become skillful, they are assigned more difficult tasks. For example, a typist in a typing pool may be promoted to senior typist. Receptionists who learn typing and office procedures may become secretaries or typists. Promotion to supervisor or manager generally depends on leadership ability, work experience, and knowledge of the overall operations of the organization.

Employment Outlook

Employment of clerical workers is expected to increase rapidly through the mid-1980's. In addition to jobs created by growth, thousands of openings will occur as employees die, retire, or leave their jobs.

The growth in the number of clerical workers is expected to result primarily from the increasing paperwork that will accompany the expansion of large and complex organizations. Employment opportunities will be best for secretaries, typists, and other skilled workers whose jobs are not likely to be handled by machines. Demand for these workers will be particularly strong in banks, insurance companies, manufacturing firms, government of-



fices, and professional service organizations.

As more firms use computers and business machines, routine clerical jobs such as payroll, stock, bank, and file clerks may be reduced or eliminated. However, as work is shifted from clerks to machines, new jobs will be created for machine operators, particularly in large urban business firms.

Many clerical workers, including secretaries, receptionists, and others who deal with the public and who exercise initiative, will not be affected by automation.

Earnings and Working Conditions

Clerks in routine jobs earned as little as $83 a week and some experienced and highly skilled employees earned up to $162 a week, according to a 1972 Bureau of Labor Statistics survey. Salary variations within an occupation usually reflect differences in educational levels and work experience.

Salaries in different parts of the country also vary; earnings generally are lowest in southern cities and highest in northeastern and western urban areas. For example, secretaries averaged $141 a week in the Northeast, $142 in the West, and $126 in southern cities.

Office employees work a 40-hour week in most cities. In some, especially in the Northeast, the scheduled work week is 37½ hours.

Most office workers in large cities receive 7 or more paid holidays a year and 2 weeks vacation after working 1 year. Longer vacations, based on added years of service, may range to 4 weeks or more. Group life and health insurance plans, sick benefits, and retirement plans may be available.

Sources of Additional Information

Many State employment service offices can provide information about earnings, hours, and employment opportunities in clerical jobs.

Information concerning training for clerical occupations is available from:

State Supervisor of Office Occupations Education, State Department of Education, State Capitol.

Teachers should contact:

Division of Vocational and Technical Education, Bureau of Adult Vocational and Library Programs, U.S. Office of Education, Washington, D.C. 20202.

A directory of private business schools located in cities throughout the country may be obtained from:

United Business Schools Association, 1730 M St., NW., Washington, D.C. 20036.

Bookkeeper records business transactions.

BOOKKEEPING WORKERS

(D.O.T. 210.368 through .588, 216.388, and 219.388 and .488)

Nature of the Work

Every business needs systematic and up-to-date records of accounts and business transactions. Bookkeeping workers maintain these records in journals, ledgers, and on other accounting forms. They also prepare periodic financial statements showing all money received and paid out. The duties of bookkeeping workers vary with the size of the business in which they work.

In many small firms, a *general bookkeeper* (D.O.T. 210.388) is the only bookkeeping worker. He analyzes and records all financial transactions, such as orders and cash sales. He also does the other bookkeeping work involved in operating a business, which includes checking money taken in against that paid out to be sure accounts "balance" and calculating the firm's payroll. Although most of this work is done by hand, occasionally a bookkeeper uses simple office equipment such as an adding machine. A general bookkeeper also does other office work such as preparing and mailing customers' bills and answering the telephone.

Large businesses usually have many bookkeepers and accounting clerks under the direction of a head bookkeeper. Bookkeepers may specialize in certain types of work such as preparing statements on a company's income from sales or its daily operating expenses. They may use complex bookkeeping machines. *Accounting clerks* (D.O.T. 219.488), who sometimes are known as book-

keeping clerks, perform a variety of routine duties. They record details of business transactions, including deductions from payrolls and bills paid and due. They also may type vouchers, invoices, and other records.

Places of Employment

Bookkeeping workers numbered over 1.5 million persons in 1972. About 90 percent were women. Although jobs for bookkeeping workers are found in all kinds of firms, most work in retail stores, factories, banks, and insurance companies. Large numbers also work in wholesale firms, hospitals, and schools.

Training, Other Qualifications, and Advancement

High school graduates who have taken business arithmetic, bookkeeping, and accounting meet the minimum requirements for most bookkeeping jobs. Some employers, however, prefer applicants who have completed business courses at a junior college or business school.

Persons also may qualify for bookkeeping jobs through on-the-job training. In some areas, companies cooperate with business schools and high schools in work-study programs offering part-time experience that helps students get a job after graduation.

Bookkeeping workers need above average aptitude for working with numbers and the ability to concentrate on details. They should be able to type and operate various office machines. Because bookkeepers depend on other office workers for information, persons in these jobs should be able to work as part of a team.

Newly hired bookkeeping workers begin by recording routine transactions and advance to more responsible assignments, such as preparing income statements and operating complex bookkeeping machines. Some workers are promoted to supervisory jobs. Bookkeepers who complete courses in college accounting may become accountants. (The occupation of accountant is discussed elsewhere in the *Handbook*.)

Employment Outlook

Although the number of bookkeepers will increase slowly through the mid-1980's, thousands of workers will be needed each year. Most job openings will be due to deaths, retirements, and transfers.

Despite the expected increase in the volume of recordkeeping, employment growth in this occupation will be slowed by the use of electronic data processing and other bookkeeping machines. Many types of machines can process data more accurately, rapidly, and economically than workers doing it by hand. Nevertheless, the need for bookkeeping workers probably will outpace the impact of laborsaving office machines over the next decade.

Earnings and Working Conditions

Beginning accounting clerks in private firms averaged $489 a month in 1972, according to a Bureau of Labor Statistics survey of clerical occupations. Experienced clerks earned $628 a month, about the same as the average for all nonsupervisory workers in private industry, except farming. Relative earnings of bookkeeping workers have decreased slowly over the last ten years.

Accounting clerks working in cities for firms employing at least 2,500 people earned the highest salaries. Earnings also varied by industry; public utilities paid higher than average salaries, while workers in stores, banks, and insurance companies made less than the average.

Beginning bookkeeping workers in the Federal Government had monthly earnings which ranged from $430 to $485. Experienced workers were paid from $545 to $610 a month.

Working conditions for bookkeepers are similar to those of other office workers in the same firms. (See introductory section to this chapter for more information on Earnings and Working Conditions and for Sources of Additional Information.)

CASHIERS

(D.O.T. 211.138, .368, .468, .488, and 299.468)

Nature of the Work

Supermarkets, movie theaters, and restaurants are among the many businesses that employ cashiers to handle payments from customers. Most cashiers receive money, make change when necessary, fill out charge forms, and give receipts. Some also keep records of the amount of each transaction so that at the end of the day accounts can be balanced. Many cashiers prepare cash and checks for deposit at the bank and pay for company supplies and equipment. Some prepare pay envelopes or paychecks and make out sales tax reports. (The occupation of bank cashier, which is different from other cashier jobs, is discussed elsewhere in the *Handbook*.)

In addition to these duties, cashiers, depending on their employers, may do other jobs and have different job titles. Those who work in theaters, for example, (often called *box office cashiers or ticket*

sellers) operate ticket-dispensing machines and answer telephone inquiries. Restaurant cashiers, sometimes called *cashier checkers* or *hostess-cashiers*, handle reservations for meals and special parties, type menus, or sell items at the candy and cigarette counter. In supermarkets and other self-service stores, cashiers known as *check-out clerks*, *checkers*, or *grocery clerks* wrap or bag purchases and, during slack periods, may restock shelves and mark prices. In many offices, cashiers, known as *agency* or *front-office cashiers*, type, operate the switchboard, do bookkeeping, and act as receptionists.

Cashiers operate several types of machines. Most use cash registers which print the amount of the sale on a paper tape and release a money drawer. A growing number operate computerized registers that calculate the necessary taxes automatically and record inventory numbers. Others, especially those who work in hotels and hospitals, use machines that record the charges for telephone, medical, and other services and prepare itemized bills. Cashiers also may operate adding and change-dispensing machines.

Places of Employment

In 1972, about 1 million persons, over 85 percent of them women, were employed as cashiers. Although cashiers are found in businesses of all types and sizes, more than four-fifths work in grocery, drug, and other retail stores. Large numbers also are employed in restaurants and theaters. Most of the businesses employing cashiers are located in cities or suburban shopping centers; however, many also are found in small towns.

Training, Other Qualifications, and Advancement

Employers prefer that beginning cashiers have high school diplomas. Courses in business arithmetic, bookkeeping, typing, and other business subjects are good preparation. The Federal Government sponsors programs to train unemployed and underemployed workers for entry positions as cashiers under provisions of the Manpower Development and Training Act and other legislation. Cashier training also is offered as part of many public school vocational programs.

Many employers provide on-the-job training for cashiers. In a small firm this training may be informal as the beginning cashier works under supervision of an experienced employee. In large firms, training is more formal and may include classroom instruction in various phases of a cashier's job.

For some cashier jobs, employers seek persons who have special skills or business experience, such as typing or selling. Many cashier openings are filled by promoting clerk-typists in offices, baggers in supermarkets, and other qualified workers already employed by the firm.

Young persons planning to become cashiers should be able to do repetitious work accurately. They need finger dexterity, a high degree of eye-hand coordination, and an aptitude for working with figures. Because they meet the public, cashiers should be neat in appearance and able to deal tactfully and pleasantly with their customers.

Promotion opportunities for cashiers are likely to be limited, particularly in small firms. However, the cashier's job affords a good opportunity to learn an employer's business and so may serve as a steppingstone to a more responsible clerical job or managerial position. Cashiers working in chain stores and other large retail businesses, for example, may advance to department or store managers.

Employment Outlook

Employment in this large occupation is expected to increase rapidly through the mid-1980's due to continued expansion of business activity. In addition, the trend to self-service merchandising will spur the demand for cashiers to perform check-out duties formerly handled by salesworkers. Thousands of workers will be needed each year to fill new jobs and to replace those who leave the occupation.

Opportunities probably will continue to be best for cashiers having typing and bookkeeping skills. There also should be many chances for part-time work.

Earnings and Working Conditions

Beginning cashiers often earn the minimum wage required by law. In several States and in establishments covered by the Federal law, the minimum was $1.60 an hour in 1972; elsewhere, starting salaries were somewhat lower. Unionized cashiers and some in highly responsible jobs or those requiring specialized training often earn more than $3 an hour. Grocery checkers in supermarkets sometimes earn more than $4 an hour.

Cashiers often work during rush periods which are outside regular office hours. Holiday, weekend, late afternoon, and evening work may be required, especially in theaters, restaurants, and food stores. Many cashiers in these establishments work part time or on split shifts. Those employed full time in supermarkets and other large retail stores usually work a 5-day, 40-hour week; however, they generally work on Saturday and have another day off during the week.

Most cashiers work indoors, often in small booths or behind counters located near store entrances. In some cases, they are exposed to cold drafts in the winter and considerable heat during the summer. (See introductory section of this chapter for Sources of Additional Information.)

FILE CLERKS

(D.O.T. 132.388, 205.368, 206.388, 219.588, 920.887)

Nature of the Work

An orderly file system is often the key to an efficient office. In most offices, records are arranged to prevent time and money losses caused by inability to locate information quickly. This system creates job opportunities for file clerks, who keep records accurate, up to date, and properly placed.

File clerks handle office information by classifying, storing, updating, and retrieving it on request. To do this, they read incoming material and put it in order for future use by means of some system like number, letter of the alphabet, subject matter, or other. When these records are requested, file clerks locate them and turn them over to the borrower. They keep track of materials removed from the files and make sure that those given out are returned.

Some clerks operate mechanized files which rotate to bring the needed records to them. Others retrieve documents or spools of microfilm, and place them in an electronic transmitter which displays the information on video terminals located elsewhere in the organization. Records also must be up-to-date in order to be useful. File clerks make sure that new information is added to existing files shortly after it is received.

From time to time, file clerks have other duties, in addition to storing, updating, and retrieving data. For example, they may destroy outdated file materials or transfer them to inactive storage. They check files at regular intervals to insure that all items are correctly placed. Whenever data cannot be located, the file clerk searches for the missing records. As an organization's needs for information change, file clerks modify old filing systems or establish new ones.

In small offices, file clerks often type, sort mail, or operate duplicating machines. Those who work with automated filing systems may code and microfilm all incoming documents.

Places of Employment

About 270,000 persons—85 percent of them women—worked as file clerks in 1972. One out of every five worked part time. In addition, many other clerical workers have some filing tasks in connection with their work.

Although filing jobs are found in almost every kind of organization, nearly one-half of all file clerks work in either banks, insurance companies, or factories.

Training, Other Qualifications, and Advancement

Employers prefer high school graduates for beginning file clerks. Many seek applicants who can type, and who have some knowledge of office practices as well. High schools, colleges, and private business schools teach these and other skills that help a beginner to get a job. The Federal Government also sponsors programs to train unemployed and underemployed workers for entry positions as file clerks. This training is offered under provisions of the Manpower Development and Training Act and other legislation.

Some on-the-job training usually is necessary because each organization has its own filing system and office procedures. In organizations that have specialized filing procedures, clerks learn their jobs in a few weeks. Learning to operate mechanical filing systems usually takes more time. Where file clerks have a variety of related duties, training may take up to three months.

File clerks must read accurately and rapidly, spell well, and like detailed work. They should be neat, able to work as part of a team, and not easily bored by repeated tasks.

File clerks can advance to more difficult filing duties and to jobs supervising other file clerks. Those who improve their skills may be promoted to office machine operators, receptionists, and typists.

Employment Outlook

Employment of file clerks is expected to grow moderately through the mid-1980's as business expansion creates a need for more and better recordkeeping. Also, many file clerks will be needed each year to replace those who die, retire, or transfer to other jobs.

The increasing use of computers to arrange, store, and transmit information will cause the occupation to grow less rapidly than in recent years. However, the growing volume of paper work and continued expansion of those businesses that hire many file clerks should assure steady employment.

Earnings and Working Conditions

According to a Bureau of Labor Statistics survey, beginning file clerks in urban areas averaged $96 a week in 1972. Weekly salaries of those having some experience averaged $105; of those having a great deal of experience, $130. File clerks earn about three-fourths as much as the average for nonsupervisory workers in private industry, except farming.

In the Federal Government, beginning file clerks without high school diplomas started at about $92 a week in early 1973; high school graduates averaged $104 a week, and experienced clerks $118.

Working conditions for file clerks usually are similar to those for other office workers in the same organization. Although they do not do heavy lifting, they often must stoop, bend, and reach. (See the statement on Clerical Occupations for more information on Earnings and Working Conditions and for Sources of Additional Information.)

HOTEL FRONT OFFICE CLERKS

(D.O.T. 242.368)

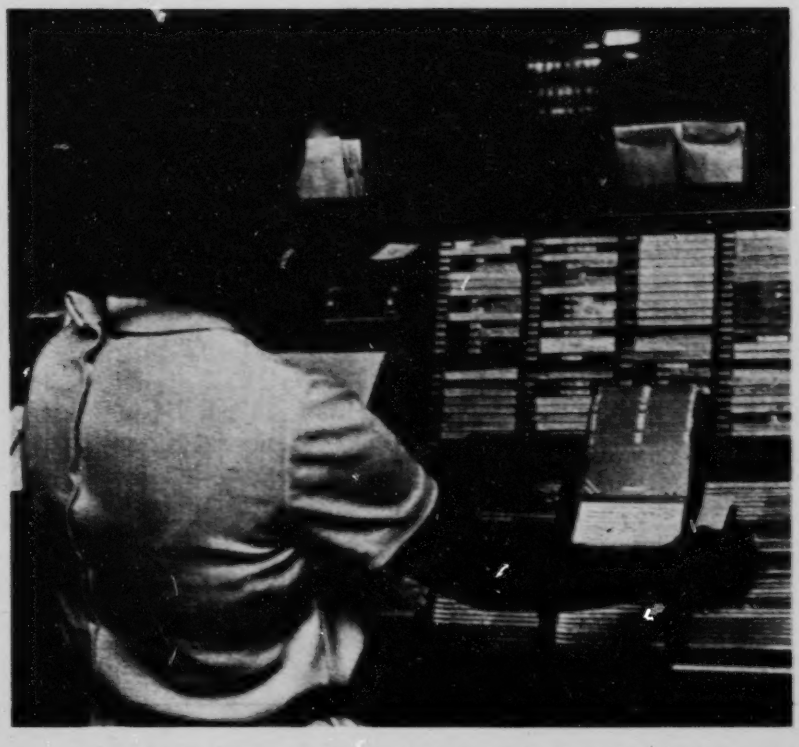
Nature of the Work

Hotels and motels employ front office clerks to rent rooms, greet guests, issue keys, and handle mail. By working "up front," these clerks deal directly with the public and help build the hotel's reputation. In small hotels and in many motels, front office clerks (who are sometimes owners) also may work as bookkeepers, cashiers, or telephone operators. Large hotels usually employ several front office clerks for different jobs, such as handling mail or information, or as key clerk. In the largest hotels, floor supervisors or floor clerks handle distribution of mail, packages, and telegrams. Almost 50,000 persons—most of them men—worked as front office clerks in 1972.

Room or desk clerks rent available rooms. Usually, they are the first of the front office clerical staff to greet guests. In assigning rooms, they must consider reservations, guests' preferences, and, at the same time, try to maximize hotel revenues. These clerks give information about rates and services and see that registration forms are properly filled out. After check-in is completed hotel room clerks signal bellmen who escort guests to their rooms. *Reservation clerks* acknowledge written or wired requests for rooms, type out registration forms, and notify the room clerk when guests are due to arrive. *Rack clerks* keep room assignment records to advise housekeepers, telephone operators, and others concerned with room occupancies when rooms are occupied, vacant, or closed for repairs.

Training, Other Qualifications, and Advancement

High school graduates who have some clerical aptitude may be hired for beginning jobs as mail, information, or key clerks. A knowledge of bookkeeping may be helpful in smaller hotels or on nightshift work



Front office clerk keeps room occupancy information current.

where additional duties may be performed. Occasionally, employees in other related work—for example, bellmen or elevator operators—may be transferred to front office jobs. Although education beyond high school generally is not required for front office work, college training is an asset for advancement to managerial jobs. Neatness, a courteous and friendly manner, and ease in dealing with people are important traits for front office clerks.

Inexperienced workers learn about the front office routine mainly on the job. They usually have a brief training period which describes duties and gives information about the hotel such as room locations and services offered. Once on the job, they receive help from the assistant manager or an experienced front office worker.

Most hotels promote front office workers from within so that a key or rack clerk may be promoted to room clerk, then to assistant front office manager, and later to front office manager. Clerks may improve their opportunities for promotion by taking home study courses such as those sponsored by the Educational Institute of the American Hotel and Motel Association. (See statement on Hotel Managers and Assistants elsewhere in the *Handbook*.)

Employment Outlook

Employment is expected to increase very rapidly through the mid-1980's as hundreds of hotels, motels, and motor hotels open or expand. In addition to new front office jobs created by growth, many openings will result from the need to replace workers who are promoted, transfer to other occupations, or stop working. A front office clerk has a relatively stable job which is not usually affected by changes in general economic conditions.

See the Hotel statement elsewhere in the *Handbook* for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

OFFICE MACHINE OPERATORS

(D.O.T. 207.782, .884, and .885; 208.782, 213.782, 214.448, 215.388, 216.488, 234.582, and .885)

Nature of the Work

To speed paper work, modern business offices use a variety of machines ranging from the simple letter opener to complicated equipment for involved computations. This statement presents information on the work of people who operate some of the more common types of office machines. Many, such as the bookkeeping and billing machine operators, have job titles related to the kind of equipment they use. (Excluded from this section but discussed in the *Handbook* are operators of transcribing machines, typewriters, and computers; clerical workers who occasionally use copying or adding machines; and statistical clerks who use calculators.)

Billing machine operators (D.O.T. 214.488) use machines that type and add in order to prepare customers' statements. The customer's name and address, items bought, and price are entered on each bill. The machine calculates and prints totals, discounts, and other items.

Bookkeeping machine operators (D.O.T. 215.388) use office ma-

Office machine operators need manual dexterity.

chines that record all financial transactions of a business on bookkeeping forms. Operators using bookkeeping machines also prepare trial balances, summary reports, and other statistical information.

Adding and calculating machine operators (D.O.T. 216.488) use electrically and manually-operated machines to compute payrolls and invoices and do other statistical work. Desired totals and results are automatically computed. *Adding machine operators* use machines to add and subtract and sometimes to multiply. *Calculating machine operators* and *Comptometer operators* use more complex machines to add, subtract, multiply, divide, and compute square roots and percentage distributions. Although many office workers operate adding machines and calculators in addition to other duties, these employees are full-time, trained calculator operators.

Mail preparing and mail handling machine operators (D.O.T. 234.582 and .885) run automatic equipment that handles incoming and outgoing mail. Some machines open the envelopes; others fold and insert enclosures or address, seal, and stamp envelopes. Addressing machines print addresses from stencils cut by typists or from plates prepared by *embossing machine operators* (D.O.T. 208.782) who use a special kind of typewriter.

Duplicating machines reproduce documents more quickly and inexpensively than they can be typed. Although any office employee can operate some of this equipment, machines which produce thousands of copies in a single "run" usually require full-time trained *duplicating machine operators* (D.O.T. 207.782, .884, and .885) who keep the equipment properly adjusted. In some machines, the paper is fed and removed manually; in other machines, these operations are automatic.

Operators of tabulating machines and related equipment (D.O.T. 213.782) run machines that sort and count quantities of accounting and statistical information. Cards are inserted into tabulating machines that count the various items on each card, multiply, and make other calculations. The results are printed on accounting records and other business forms.

Places of Employment

In 1972, about 200,000 people—three-fourths of them women—worked as office machine operators. (This total does not include over 450,000 computer operating personnel who are discussed under Computer and Related Occupations elsewhere in the *Handbook*.)

About one-third of all office machine operators work for manufacturing companies. Large numbers also work for banks and insurance companies, government agencies, and wholesale and retail stores. Others prepare monthly bills and mailing circulars in service centers for firms that do not have their own office machinery.

Training, Other Qualifications, and Advancement

Employers prefer high school or business school graduates for beginning office machine operators. Most newly hired workers also are expected to operate basic office equipment, such as adding machines and calculators. Courses in business arithmetic and typing are useful because many positions involve varied assignments.

The amount of instruction and on-the-job training beginners receive depends on the types of machines they operate. Although a few days may be enough to train operators of some duplicating machines, a few weeks may be needed to train key-driven calculating machine operators. These operators often are trained at

company expense in schools run by equipment manufacturers. The Federal Government also sponsors programs to train unemployed and underemployed workers for entry positions as office machine operators under provisions of the Manpower Development and Training Act, and other legislation.

Finger dexterity, eye and hand coordination, and good vision are important for most office machine operator jobs. Billing and calculating machine operators should understand mathematics so they can detect obvious errors in computations. Some mechanical ability is advantageous, especially for duplicating and tabulating machine operators.

Most employers promote from within and give strong consideration to seniority and job performance as shown by supervisors' ratings. Promotion may be from a routine machine job to a more complex one, or to a related clerical job. Employers often provide needed additional training. In firms having large clerical staffs, office machine operators may advance to jobs where they train beginners or to supervisory positions as section or department heads.

Employment Outlook

Employment of office machine operators will grow slowly through the mid-1980's as businesses introduce new types of recording and copying equipment. In addition to openings that will result from growth, many jobs will arise as operators die, retire, or transfer to other work.

Despite expected growth in the volume of billing, computing, and duplicating work, the occupation will expand only slowly as automated record-keeping systems spread. In addition, advances in computer technology and data transmission devices will enable large employers to centralize record keeping, and to reduce somewhat requirements for operators in branch offices.

Earnings and Working Conditions

A 1972 Bureau of Labor Statistics survey in urban areas provides figures on earnings for several office machine operator occupations. The lowest salaries were paid in the South and the highest in the North and West.

For some occupations averages are given separately for different skill groups. Operators in Class A were very experienced and performed comparatively difficult work. Those in Classes B and C had some or no experience, worked on more routine assignments, and used simpler equipment. The average weekly salaries reported by this survey are shown in the accompanying tabulation:

	Average Weekly Salaries, 1972
Billing machine Operators	$117.00
Bookeeping machine operators	
Class A	126.00
Class B	104.50
Comptometer operators	116.50
Tabulating machine operators	
Class A	165.50
Class B	137.50
Class C	115.00

Billing and bookkeeping machine operators earned slightly less than the average for all nonsupervisory workers in private industry, except farming.

Because of the noise of machines, groups of operators often work in areas which are apart from other company offices. In other respects, their working conditions usually are similar to those of other office workers in the same firms. (See the statement on Clerical Occupations for further information on Working Conditions and for Sources of Additional Information.)

POSTAL CLERKS

(D.O.T. 231.688, 232.138 and .368)

People are most familiar with the window clerk who sits behind the counter in post office lobbies selling stamps or accepting parcel post. However, the majority of postal clerks are distribution clerks who sort incoming and outgoing mail in workrooms. Only in a small post office does a clerk do both kinds of work.

When mail arrives at the post office it is dumped on long tables where distribution clerks and mail handlers separate it into groups of letters, parcel post, and magazines and newspapers. Clerks feed letters into stamp-canceling machines and cancel the rest by hand. The mail is then taken to other sections of the post office to be sorted by destination. Clerks first separate the mail into primary destination categories: mail for the local area, for each nearby State, for groups of distant States, and for some of the largest cities. This primary distribution is followed by one or more secondary distributions. For example, local mail is combined with mail coming in from other cities, and sorted according to street and number. In post offices with electronic mail-sorting machines, clerks simply push a button corresponding to the letter's destination, and the letter drops into the proper slot.

The clerks at post office windows provide a variety of services in addition to selling stamps and money orders. They weigh packages to

In many large post offices, postal clerks use electronic machines to sort mail.

determine postage and check to see if their size, shape, and condition are satisfactory for mailing. Clerks also register and insure mail and answer questions about postage rates, mailing restrictions, and other postal matters. Occasionally they may help a customer file a claim for a damaged package. In large post offices a window clerk may provide only one or two of these services and called a registry, stamp, or money order clerk.

Training, Other Qualifications, and Advancement

Postal clerks must be at least 18 and pass a four-part written exmination. The first part tests reading accuracy by asking the applicant to compare pairs of addresses and indicate which are identical. The second part tests ability to follow oral instructions. The third measures general intelligence, including vocabulary, and the fourth tests ability to do simple arithmetic. Applicants who work with an electronic sorting machine must pass a special examination which includes a machine aptitude test. They must pass a physical examination and may be asked to show that they can lift and handle mail sacks weighing up to 70 pounds.

Applicants should apply at the post office where they wish to work because each post office keeps a separate list of those who have passed the examination. Applicants' names are listed in order of their scores. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. Disabled veterans who have a compensable, service-connected disability of 10 percent or more are placed at the top of the list. When a vacancy occurs, the appointing officer chooses one of the top three applicants; the rest of the names remain on the list for future appointments.

New clerks are trained on the job. Most clerks begin with simple tasks to learn regional groupings of States, cities, and ZIP codes. To help clerks learn these groups, many post offices offer classroom instruction.

A good memory, good coordination, and the ability to read rapidly and accurately are important.

Distribution clerks work closely with other clerks, frequently under the tension and strain of meeting mailing deadlines. Window clerks must be tactful when dealing with the public, especially when answering questions or receiving complaints.

Postal clerks are classified as casual, part-time flexible, part-time regular, or full-time. Casual workers are hired to help handle the large amounts of mail during the Christmas season. Part-time flexible employees do not have a regular work schedule, but replace absent workers or help with extra work loads as the need arises. Part-time regulars have a set work schedule—for example, 4 hours a day.

Most clerks begin as part-time flexible employees and become full-time workers as vacancies occur. As their seniority increases, they may bid for preferred assignments such as the day shift, a window job, or a higher level nonsupervisory position as stamp supply clerk or claims clerk. The supervisory examination may be taken after 4 to 5 years of service.

Employment Outlook

Employment of postal clerks —who numbered 286,000 in 1972— is expected to grow slowly through the mid-1980's. Most openings will result from the need to replace clerks who retire, die, or transfer to other occupations.

Although the amount of mail post offices handle is expected to grow as both population and the number of businesses grow, modernization of post offices and installation of new equipment will increase the amount of mail each clerk can handle. For

example, machines which semiautomatically mark destination codes on envelopes are now being tested. These codes can be read by computer-controlled letter sorter machines which automatically drop each letter into the proper slot for its destination. With this system, clerks read addresses only once, at the time they are coded, instead of several times, as they now do. Eventually this equipment will be installed in all large post offices.

Earnings and Working Conditions

Earnings of postal clerks are related to the size of the post office where they work. Earnings are higher in larger post offices because clerks in these jobs process more regular mail, and more mail requiring special handling, than do clerks in smaller post offices.

Most clerks are at the grade 5 level and in mid-1972 those working a part-time flexible schedule began at $4.02 and could reach $5.13 an hour after 7 years. Clerks working full-time earned $8,072 a year and could advance to $10,657 after 7 years. Clerks who worked in third- and fourth-class post offices were at the grade 3 level. All clerks who work night shifts receive 10 percent additional pay.

Working conditions of clerks differ according to the specific work assignments and the amount and kind of laborsaving machinery in the post office. In small post offices clerks must carry heavy mail sacks from one part of the building to another, and sort the mail by hand. In large post offices, chutes and conveyors move the mail and much of the sorting is done by machine. In either case, clerks are on their feet most of the time, reaching for sacks of mail, placing packages and bundles into sacks while sorting and walking around the workroom.

Distribution clerks may become bored with the routine of sorting mail unless they enjoy trying to improve their speed and accuracy. They also may have to work at night, because most large post offices process mail around the clock.

A window clerk, on the other hand, has a greater variety of duties, has frequent contact with the public, generally has a less strenuous job, and never has to work a night shift.

(For information on fringe benefits, see statement on postal service occupations elsewhere in the *Handbook*.)

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and empoyment opportunities for postal clerks.

RECEPTIONISTS

(D.O.T. 235.862, 237.368)

Nature of the Work

All organizations want to make a good first impression on the public. This is an important part of the job of the receptionist, who generally is the first person a caller sees.

Receptionists greet customers and other visitors, determine their needs, and refer callers to the officials who can help them. Receptionists in hospitals, after obtaining personal histories, direct patients to the proper waiting rooms; in beauty shops, they arrange appointments and show customers to the operator's booth; and in large plants, they provide callers with identification cards and arrange escorts to take them to the proper office.

Many receptionists keep business records of callers, the times at which they called, and the persons to whom they were referred. When they are not busy with callers, receptionists may type, file, or operate a switchboard. Some receptionists open and sort mail and collect and distribute messages. Still others prepare travel vouchers and do simple bookkeeping.

Places of Employment

About 435,000 persons—97 percent of them women—worked as receptionists in 1972. Nearly 1 out of 10 worked part time.

Although there are jobs for receptionists in almost every kind of organization, over half work for doctors, lawyers, or other professional people. Large numbers also work in hospitals, insurance companies, banks, factories, and businesses providing personal services.

Training, Other Qualifications, and Advancement

A high school diploma generally is required for work as a receptionist. Courses in English, spelling, typewriting, elementary bookkeeping, and business practices are helpful to the beginner.

Liking people and wanting to help them are assets to the receptionist. A neat appearance, pleasant voice, and even disposition also are important. Because receptionists do not work under close supervision, common sense and a thorough understanding of how the business is organized help them handle various situations that arise.

Promotion opportunities for receptionists are limited, especially in small offices. In large work places, however, a receptionist who has clerical skills may advance to a

Receptionist checks correspondence.

better-paying job as a secretary or administrative assistant. Many companies have their own training programs so that the skills needed for advancement can be learned on the job. College or business school training also can be helpful in advancing to better-paying office jobs.

Employment Outlook

Employment of receptionists is expected to grow very rapidly during the next ten years. Thousands of openings will result each year as businesses providing personal and professional services expand and as those who die, retire, or transfer to other jobs are replaced. In addition, more firms are realizing the importance of the receptionist in promoting good public relations. Because the receptionist's work is of a person to person nature, it is unlikely to be affected by office automation.

Earnings and Working Conditions

According to a Bureau of Labor Statistics survey, full-time switchboard/receptionists working in urban areas averaged $108 a week in 1972. This was slightly under the average earnings for non supervisory workers in private industry, except farming. Receptionists working in the Western United States had average weekly earnings of $113. Those in Southern cities averaged $100 a week.

In the Federal Government, beginning information receptionists earned $104 a week in early 1973.

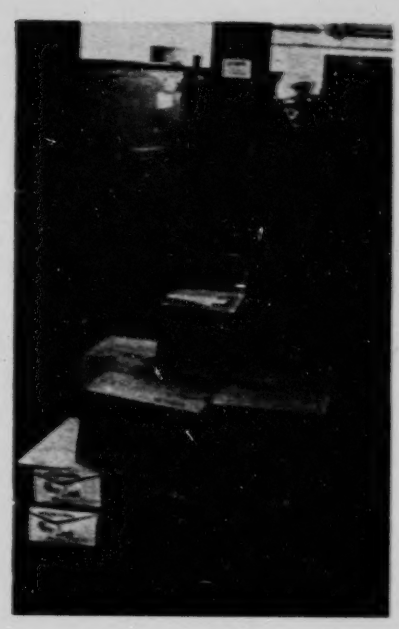
Receptionists usually are confined to specific work areas that are comfortably furnished. Although most have regular hours, receptionists in hospitals and beauty shops may work evenings and weekends. (See the statement on Clerical Occupations for Sources of Additional Information.)

SHIPPING AND RECEIVING CLERKS

(D.O.T. 209.688, 219.388, 222.138 through .687, 223.387, 239.588, 910.368 and 920.887)

Nature of the Work

Shipping and receiving clerks keep track of goods transferred between firms and their customers and suppliers. In small companies, one clerk may keep records of all shipments sent out and sent out and received; in larger companies, many clerks take care of this recordkeeping.



Shipping clerks are responsible for all shipments leaving a business place. Before goods are sent to a customer, these clerks check to be sure the order has been filled correctly. They obtain merchandise from the stock room, and wrap it or pack it in shipping containers. Clerks also put addresses and other identifying information on packages, look up and compute either freight or postal rates, and record the weight and cost of each shipment. They may also be responsible for preparing invoices and furnishing information about shipments to other parts of the company, such as the accounting department. Once a shipment is checked and ready to go, shipping clerks may move it to the shipping dock and direct its loading on trucks according to different shipments' destinations. Shipping and receiving clerks working in small firms may combine the various duties of stock clerks in their jobs. (For more information about the additional duties of shipping clerks in small firms, see statement on Stock Clerks elsewhere in *Handbook*.)

When shipments arrive, receiving clerks perform tasks similar to shipping clerks. They determine whether their employer's orders have been correctly filled, by verifying incoming shipments against the original order and the accompanying bill of lading or invoice. They record the receipt and condition of incoming shipments. Clerks also make adjustments with shippers for lost and damaged merchandise. Routing or moving shipments to the proper department, warehouse section, or stockroom, and providing information that is needed to compute inventories, also may be part of their job.

Places of Employment

About 450,000 persons—85 percent of them men—worked as shipping and receiving clerks in 1972. More than half worked in factories; large numbers also were employed by wholesale houses or retail stores. Although jobs for shipping and receiving clerks are found in all localities, most clerks work in urban areas.

Training, Other Qualifications, and Advancement

High school graduates are preferred for beginning jobs in shipping and receiving departments. Business arithmetic, typing, and other high school business subjects are helpful for completing paperwork. The ability to write legibly is important. Dependability and an interest in learning about the firm's products and business activities also are qualities which employers seek. In addition, shipping and receiving clerks should be able to work under close supervision at repetitive tasks.

New employees usually are trained on-the-job by an experienced worker. As part of their training they often file, check addresses, attach labels, and check items included in shipments. As clerks gain experience, they may be assigned tasks requiring a good deal of independent judgment, such as handling problems of damaged merchandise, or supervising other workers in shipping or receiving rooms.

Work as a shipping or receiving clerk offers a good opportunity for an ambitious young person to learn about his company's products and business practices. Some clerks may be promoted to head shipping or receiving clerks or warehouse managers. Others may enter related fields such as industrial traffic management or purchasing. (Industrial traffic managers and purchasing agents are discussed elsewhere in the *Handbook*.)

Employment Outlook

Employment of shipping and receiving clerks is expected to rise slowly through the mid-1980's as population growth and business expansion increase the quantity of goods distributed. Several thousand jobs will become available each year as employment grows and as workers retire, die, or transfer to other occupations.

Although substantial growth is expected in the volume of goods distributed, employment of shipping and receiving clerks will increase at a somewhat slower rate as fewer clerks handle a greater volume of goods. This results from more firms using computers to keep track of shipping and receiving records, and moving belts to handle shipments once lifted by hand.

Earnings and Working Conditions

Shipping and receiving clerks in urban areas averaged $3.50 an hour in 1972, according to a Bureau of Labor Statistics survey. This is about as much as the average earnings for all nonsupervisory workers in private industry, except farming. Salaries of these workers varied by type and location of employer. For example, shipping and receiving clerks employed in the Western United States averaged $3.26 an hour, while those in the South earned $2.79 an hour.

Many shipping and receiving clerks receive time-and-a-half for work over 40 hours. Nightwork and overtime, including work on Saturdays, Sundays, and holidays, may be necessary when shipments have been unduly delayed or when materials are needed immediately on production lines. Although shipping and receiving clerks do much of their work in warehouses or in shipping and receiving rooms, they may do

some of it on outside loading platforms. Work places often are large, unpartitioned areas which may be drafty, cold, and littered with packing materials.

Some of the work that shipping and receiving clerks do takes physical stamina and strength. Most clerks must stand for long periods while they check merchandise. Locating numbers and descriptions on cartons often requires a great deal of bending, stooping, and stretching. Also, under the pressure of getting shipments moved on time, clerks may help load or unload materials in the warehouse. (See introductory section of this chapter for Sources of Additional Information.)

STATISTICAL CLERKS

(D.O.T. 205.368, 206.588, 209.588, 219.388, .488, .588, 222.687, 223.588, 913.368, 953.168)

Nature of the Work

Administrators and managers in all types of organizations depend on numerical records to help make decisions. Statistical clerks prepare and insure the accuracy of these records. Jobs in this field can be grouped into four categories: recording, compiling and coding, computing and tabulating, and scheduling.

Recording. This work involves collecting, recording, and verifying the accuracy of information. *Shipping checkers* in manufacturing companies and in wholesale and retail businesses (D.O.T. 222.687) insure that merchandise is ready for shipment, is properly labeled, and contains the desired number of items. *Car checkers* for railroads (D.O.T. 209.588) record shipments as they arrive or leave a freight terminal. They check railroad car numbers, contents and weights of shipments to verify specifications on the invoice. *Talleymen* (D.O.T. 223.588), who may have a title referring to their work or items which they observe, record the number of materials received, transferred, or produced, and work in several industries. For example, lumber talliers or lumber checkers work in saw mills; pit recorders record production data in steel making.

Statistical clerk checks policy records for insurance company.

Compiling and coding. In organizations of all types, information must be properly filed, verified, or analyzed by data processing equipment. *Posting clerks* (D.O.T. 219.588) do this work by making entries in registers and journals. They receive and sort records of shipments, production, and finance to provide company officials with current information on business activities. *Record keepers* (D.O.T. 206.588), also known as classification clerks, record data systematically for easy location. *Coding clerks* (D.O.T. 219.388) code information for transfer to computer cards. *Personnel clerks* (D.O.T. 205.368) gather and file information on the employees of a business; their work may include some typing and preparation of reports.

Computing and tabulating. Organizations frequently use numerical records for reports and research. Statistical clerks gather information from records to present in a chart or

table for analysis. *Actuary clerks* (D.O.T. 219.388) assist actuaries in insurance companies to determine the risk involved in providing insurance coverage. They also use calculators and prepare charts and tables for studies on general insurance practices. *Policy checkers* (D.O.T. 219.488) verify insurance company records. *Statistical assistants* (D.O.T. 219.388), also known as tabulating clerks, calculate and compute numerical data for government and business research projects. *Demurrage clerks* (D.O.T. 219.388), employed by railroads, compute charges for the use of railroad tracks and calculate the weight of shipments or distance railroad cars have traveled.

Scheduling. Many business activities involve the movement of people and things, and statistical clerks do much of the required scheduling. For example, *assignment clerks* (D.O.T. 913.368) work for bus companies and assign drivers to meet riders' transportation needs. Drivers are selected on the basis of experience, length of service, and nature of the assignment. *Crew schedulers* (D.O.T. 219.388) do similar work for airlines; they assign pilots to scheduled flights and log the mileage each pilot has flown. *Gas dispatchers* (D.O.T. 953.168) determine the proper pressure of a natural gas line to meet customers' requirements after considering information such as the weather, time of day, and other factors that affect the use of gas.

Places of Employment

About 300,000 persons worked as statistical clerks in 1972. More than two-thirds were women, but some jobs were held predominately by men. For example, shipping checkers who may lift and move heavy items and assignment clerks who often are experienced bus drivers, usually are men.

Although statistical clerks are employed in nearly every industry, over half worked in finance, insurance, and real estate companies; manufacturing firms; and Federal, state, and local government.

Because businesses of almost every size require numerical records, statistical clerks work throughout the United States. Jobs are concentrated, however, in heavily populated cities that are centers of industry and government activities.

Training, Other Qualifications, and Advancement

Most employers prefer statistical clerks who are high school graduates. They also seek applicants who have logical minds, an aptitude for working with numbers, and the ability to do detailed work. Clerks should be tactful and even tempered. Courses in business arithmetic, bookkeeping, and typing are good preparation for this work.

In many companies, general clerks who have become familiar with their employers' record systems and office procedures are promoted to statistical clerk positions. On-the-job training that equips the employee to specialize in numerical work may include the use of calculators, tabulating machines, and typewriters.

Statistical clerks who observe and record data must be familiar with the items or information which they observe. For example, lumber checkers must know the various types and qualities of wood products. Statistical clerks, in compiling and coding jobs, must locate and assemble information from records in an orderly manner. In preparing data for computers, coding clerks must be careful to avoid errors.

Most employers follow a promotion-from-within policy that allows experienced workers to qualify for more responsible jobs as they become available. Qualified statistical clerks may perform more difficult assignments or advance to supervisory positions. With additional training in mathematics and extensive experience, statistical assistants may become statisticians. Many compiling-coding jobs and computing-tabulating jobs can lead the exceptional employee with specialized training to a career in computer programing and related work.

Employment Outlook

Employment of statistical clerks is expected to grow moderately through the mid-1980's. In addition to openings from growth, several thousand clerks will be needed each year to replace workers who die, retire, or transfer to other jobs.

Among the factors that will contribute to the demand for these workers is the expected increase in business and government research projects, requiring the collection and processing of large amounts of numerical data. In addition, administrators will rely increasingly on numerical records to analyze and control all aspects of their organization's work.

Although the growing use of computers to process routine information will eliminate some statistical clerk positions, most jobs involve duties that cannot be computerized. Also, the increasing use of data processing will stimulate the demand for those clerks who prepare data for computer use.

Earnings and Working Conditions

Limited information indicates that beginning statistical clerks earn about as much as workers in other entry level clerical jobs such as gen-

eral clerks or file clerks; salaries for these workers ranged between $90 and $100 a week in 1972. The entrance salary for beginning statistical clerks employed by the Federal Government was $118 a week in early 1973.

According to a recent survey, experienced workers doing statistically related clerical work, including the operation of tabulating machines or calculators, earned between $115 and $140 a week. Top level clerks and supervisors earned $165 a week and more. Earnings usually are highest in the manufacturing, transportation, and utilities industries; and lower in retail trade; finance, insurance and real estate; and service industries.

Nearly every employer of statistical clerks offers some form of health plan, insurance coverage, and retirement benefits. Most statistical clerks work in clean, well-lighted, and well-ventilated offices.

Stock clerk stores new shipment.

STOCK CLERKS

(D.O.T. 223.138, .368, .387, .388, .588, .687, 623.381, 910.388, 969.387)

Nature of the Work

Most employers recognize the importance of keeping well-balanced inventories to prevent sales losses or slowdowns in production.

Stock clerks (D.O.T. 223.387) help protect against such losses by controlling the flow of goods received, stored, and issued. They usually receive and unpack incoming merchandise or material. They may check the items against outgoing orders for quality and quantity and sometimes make minor repairs or adjustments. They also report damaged or spoiled goods and process papers necessary for obtaining replacements or credit.

Materials are stored in bins, on the floor, or on shelves according to the plan of the stockroom. Stock clerks organize and mark items with identifying codes or prices so that inventories can be located quickly and easily. They keep records of items entering or leaving the stockroom. Sometimes they label, pack, crate, or address goods for delivery.

Stock clerks working in small firms may combine the varied duties of shipping and receiving clerks. (For more information about the additional duties of stock clerks in small firms, see the statement on Shipping and Receiving Clerks elsewhere in the *Handbook*.) In large firms with specialized jobs, *inventory clerks* (D.O.T. 223.388) take periodic counts of items on hand and make reports showing stock balances. *Procurement clerks* (D.O.T. 223.368) work in factories and prepare orders for the purchase of new equipment.

The duties of stock clerks also depend on the items they handle. For example, stock clerks who work with foods and drugs must maintain proper temperature and humidity conditions; those who handle large construction items do much walking and climbing to note the condition and quantity of that stock.

Places of Employment

About 500,000 people — 80 percent of them men — worked as stock

clerks in 1972. Nearly three-fourths of the total worked in factories, wholesale firms, and retail stores. Many others were employed in mail-order houses, airlines, government agencies, hospitals, and other organizations that keep large quantities of goods on hand. Although jobs for stock clerks are found in all parts of the country, most work in urban areas where factories, warehouses, and stores are concentrated.

Training, Other Qualifications, and Advancement

Although there are no specific educational requirements for stock clerks, employers prefer high school graduates. Many look for reading and writing skills, a basic knowledge of mathematics, and typing and filing abilities. Good health, especially good eyesight, is important. Generally, those who handle jewelry, liquor, or drugs must be bonded.

Stock clerks usually receive on-the-job training. New workers begin with simple tasks such as counting and marking stock. Basic responsibilities of the job usually are learned within several weeks. As they progress, stock clerks learn to keep records of incoming and outgoing materials, take inventories, and order supplies.

This is a job where many young people start their careers. In a small firm, the stock clerk may advance to a sales position or become an assistant buyer or purchasing agent. In large firms, stock clerks can advance to more responsible stock handling jobs such as invoice clerk, stock control clerk, or procurement clerk. A few may be promoted to the stockroom supervisor's job, but additional education often is required.

Employment Outlook

Employment of stock clerks is expected to rise very rapidly through the mid-1980's as business expansion increases the quantity of goods that firms keep on hand. Many thousands of jobs will open each year as employment grows and as workers die, retire, or transfer to other occupations.

Although substantial growth is expected in the quantity of goods stocked by firms, employment will increase at a slightly slower rate as computers are used increasingly for inventory control. Because entrance into this occupation is relatively easy and many young people seek this work as a first job, some competition for openings is likely.

Earnings and Working Conditions

Stock clerks working in large cities earned average weekly salaries of $145 in 1972, according to the limited data available. This was slightly above the average for nonsupervisory workers in private industry, except farming.

In the Federal Government, inexperienced stock clerks averaged $92 a week in early 1973, experienced clerks $132.

Stock clerks usually work a 40-hour week and receive the same fringe benefits as do office employees. Those working in urban areas usually have at least seven paid holidays a year and 2 weeks of vacation after 1 year on the job. Life and health insurance and sick benefits also are generally available, as are retirement pension plans that supplement benefits paid under the Federal Social Security program.

Although stock clerks usually work in relatively clean, heated, and well-lighted areas, some stockrooms may be damp and drafty. Clerks handling refrigerated goods may spend some time in cold storage rooms. Stock clerks are on their feet much of the working day, often on a concrete floor. The job also involves considerable bending, lifting, and climbing. (See the statement on Clerical Occupations for additional information on working conditions.)

Sources of Additional Information

Information about the work and earnings of stock clerks in wholesale establishments is available from:

National Association of Wholesaler-Distributors, 1725 K St. NW., Washington, D.C. 20006.

STENOGRAPHERS AND SECRETARIES

(D.O.T. 201.268 and .368, 202.388, and 209.138)

The efficiency of any organization depends upon *stenographers* and *secretaries* who are at the center of communications within their firm. They transmit information among their employer's staff and to persons in many other organizations.

Stenographers (D.O.T. 202.388) take dictation and then transcribe their notes on a typewriter. They may either take shorthand or use a stenotype machine which prints symbols as certain keys are pressed. *General stenographers*, including most beginners, take routine dictation and do other office tasks such as typing, filing, answering telephones, and operating office machines. Experienced and highly skilled stenographers take difficult dictation and do more responsible clerical work. They may sit in on staff meetings and give a summary report or a word for word record of the proceedings. They also supervise other stenographers, typists, and clerical workers.

Stenographer transcribes her shorthand notes.

Technical stenographers must know the terms used in a particular profession. They include medical, legal, and engineering or scientific stenographers. Some experienced stenographers take dictation in foreign languages; others work as public stenographers serving traveling business people and others who require them.

Shorthand reporters are specialized stenographers who record all statements made in proceedings. About half of all shorthand reporters work as *court reporters* attached to courts of law at different levels of government. They take down all statements made at legal proceedings and present their record as the official transcript. Other shorthand reporters record the proceedings in the Congress of the United States, in State legislatures, and in both State and Federal agencies. Still others work as free-lance reporters who record out-of-court testimony, meetings and conventions, and other private activities.

Most shorthand reporters take their notes on a stenotype machine and transcribe them on a typewriter. Sometimes the reporter dictates notes on magnetic tapes that a typist can transcribe later. Because the reporter's transcript is the official record of a proceeding, accuracy is extremely important.

Secretaries (D.O.T. 201.368) relieve their employers of routine duties so that they can work on more important matters. Although most secretaries type, take shorthand, and deal with callers, the time spent on these duties varies with the type of organization where they work.

In offices where dictation and typing are handled in specialized centers, administrative secretaries handle all other secretarial duties. They often work in clusters of three or four so that they can readily help each other. Because they are released from dictation and typing, they can serve as many as 6 to 12 of the professional staff. Their duties range from filing, routing mail, and answering telephones to more responsible jobs such as answering letters, doing statistical research, and writing reports.

Some secretaries are trained in specific skills needed in certain types of work. *Medical secretaries* prepare case histories and medical reports; *legal secretaries* do legal research and help prepare briefs; and *technical secretaries* assist engineers or scientists in drafting complex reports and research proposals. Another specialized secretary is the *social secretary* (201.268), who arranges social functions, answers personal correspondence, and keeps the employer informed about all social activities.

Places of Employment

About 3 million persons—95 percent of them women—worked in occupations requiring secretarial or stenographic skills in 1972. Of this number, about 95 percent were secretaries.

More than half of all secretaries and stenographers work in banks, insurance companies, real estate firms, and government organizations. Many specialized stenographers and secretaries work for doctors, lawyers, and other professional people. Although many shorthand

reporters are court reporters, some work in firms that furnish reporting services on a contract basis.

Training, Other Qualifications, and Advancement

Generally, graduation from high school is required for a job as a stenographer or secretary. Many employers prefer applicants having additional secretarial training at a college or private business school. Courses vary from a few months' instruction in basic shorthand and typing to longer programs teaching specialized skills such as shorthand reporting or legal or medical secretarial work.

An increasing number of private firms and government agencies have their own training facilities where employees can upgrade their skills and broaden their knowledge of the organization. The Federal Government sponsors programs to train unemployed and low-skilled workers for entry jobs as stenographers and secretaries under provisions of the Manpower Development and Training Act and other legislation.

Many courts of law require their court reporter to be a Certified Shorthand Reporter (CSR). Others hire reporters with the understanding that they will be certified within one year. The National Shorthand Reporters Association gives tests for speed and accuracy to certify reporters.

Although there are many different shorthand methods, employers usually have no preferences. The most important factor in hiring and promotion is speed and accuracy. To qualify for jobs in the Federal Service—and for employment in many private firms—stenographers must be able to take dictation at 80 words per minute and type 40 words per minute. Some private firms ask beginning secretaries to take dictation at 100 words per minute and type 50 words per minute. Many shorthand reporting jobs require more than 200 words of dictation per minute; shorthand reporters in the Federal Government must take 175 words a minute.

Stenographers and secretaries should have good hearing; a knowledge of spelling, punctuation, grammar, and vocabulary is essential. The ability to concentrate amid distractions is vital for shorthand reporters. Employers look for persons who are poised and alert, and who have pleasant personalities. Discretion, judgment, and initiative are important for the more responsible secretarial positions.

Many stenographers who improve their skills advance to secretarial jobs; others, who acquire the necessary speed through additional training, can become shorthand reporters. An increasing number of executive secretaries are promoted into management positions where they use their experience and knowledge of the employing organization.

Employment Outlook

Employment of secretaries is expected to increase very rapidly through the mid-1980's as the continued expansion of business creates a growing volume of paper work. Thousands of jobs will become available each year due to growth and the need to replace those who die, retire, or stop working for other reasons.

Although the use of automatic office equipment is not expected to have a significant impact on employment of secretaries, opportunities for stenographers will be limited as more firms install dictating machines.

Earnings and Working Conditions

According to a recent Bureau of Labor Statistics survey, general stenographers working in urban areas averaged $515 a month in 1972; experienced workers who were highly skilled averaged $589. Shorthand reporters generally earn higher salaries than other stenographic workers.

According to the same survey, secretaries to supervisors of small offices earned monthly salaries of $581. Secretaries to officers in small companies had average monthly salaries of $653; those working for middle management in large companies averaged $703. Secretaries having greater responsibilities, such as executive secretaries to corporate officers, earned average monthly salaries of $758.

Beginning clerk/stenographers in the Federal Government earned from $450 to $640 a month in early 1973, depending on education, training and experience. Earnings of beginning shorthand reporters ranged from $710 to $970 a month depending on speed, education, and experience. Starting salaries for secretaries in the Federal Government ranged from $640 to $790 a month. In 1972, earnings of stenographers were slightly less, and those of secretaries somewhat more than average earnings for all nonsupervisory workers in private industry, except farming.

Working conditions for secretaries and stenographers generally are similar to those of other office workers in the same organization. Shorthand reporters, however, often sit for long periods of time while recording an event. (See the statement on Clerical Occupations for more information on Earnings and Working Conditions.

Sources of Additional Information

For information on careers in secretarial work write:

National Secretaries Association, 616 East 63rd St., Kansas City, Mo. 64110.

Additional information on careers in secretarial work and a directory of business schools is available from:

United Business Schools Association, 1730 M St. NW., Washington, D.C. D.C. 20036.

For information about shorthand reporting contact:

National Shorthand Reporters Association, 25 West Main St., Madison, Wisc. 53703.

TYPISTS

(D.O.T. 203.138 through .588; 208.588; and 209.382 through .588)

Nature of the Work

A rapid flow of written communication is essential to the modern office. The typist helps to maintain this flow by making copies of printed, handwritten, and recorded words.

Beginning or *junior typists* usually type headings on form letters, copy directly from handwritten drafts, and address envelopes. Often, they do other office tasks, including answering telephones, filing, and operating office machines such as copiers, and calculators.

More experienced typists do work that requires a high degree of accuracy and independent judgment. *Senior typists* work from rough drafts which are difficult to read or which contain technical material. They may plan and type complicated statistical tables, combine and rearrange materials from different sources, or prepare master copies to be reproduced on copying machines.

Clerk typists (D.O.T. 209.388) combine typing with filing, sorting mail, answering telephones, and other general office work. *Varitypists* (203.582) produce master copies, such as stencils, on machines similar to typewriters.

Transcribing machine operators (D.O.T. 208.588) type letters and reports as they listen to dictation recorded on magnetic tape. Other typists who have special duties include *policy writers* (D.O.T. 203.588) in insurance companies, *waybill clerks* (D.O.T. 209.588) in railroad offices, and *mortgage clerks* (D.O.T. 203.588) who work in banks.

In some offices, many typists are grouped in a pool that handles all the transcription and typing for several departments. Some of these typists handle strictly confidential documents, while others operate composing equipment that produces documents in different type sizes and styles.

Places of Employment

About 1 million persons—95 percent of them women—worked as typists in 1972. Nearly 1 out of 6 worked part time. Many other clerical workers use some typing skills in the performance of their jobs.

Although typists are employed in all kinds of organizations, about half work in factories, banks, insurance companies, and government agencies.

Training, Other Qualifications, and Advancement

Typists generally need high school diplomas. Good spelling, punctuation, and grammar are essential. Ability to operate office equipment, such as copying and adding

A growing number of businesses use automatic typewriters.

machines, and also a knowledge of office procedures, are assets.

An increasing number of companies and government organizations have their own typist training programs. These give employees a chance to learn or upgrade skills so that they can advance to more responsible positions within the organization. The Federal Government sponsors programs to train unemployed and low-skilled workers for entry positions as typists, under provisions of the Manpower Development and Training Act and other legislation.

Many employers require applicants for typing jobs to take a test that shows their speed and accuracy. For most jobs, 40 to 50 words per minute is required. All typists who transcribe recorded dictation need sharp hearing and must be especially good in spelling. Successful typists are neat, accurate, and are able to concentrate amid distractions.

As beginners increase their skills, they often advance to higher level typing jobs. Typists who learn shorthand can be promoted to secretaries or stenographers.

Employment Outlook

The number of typists is expected to grow rapidly through the mid-1980's as business expansion increases the volume of paper work. There will be several thousand job openings each year due to growth of the occupation and the need to replace those who stop working or transfer to other jobs.

Continued growth in the volume of paper work will assure excellent opportunities for typists in the years ahead. Demand should be particularly strong for highly skilled workers and those who can handle other office jobs as well as typing. Some employers will prefer typists who are familiar with new kinds of typing equipment such as high speed machines equipped with a magnetic keyboard.

Earnings and Working Conditions

According to a recent Bureau of Labor Statistics survey, beginning typists averaged $109 a week in 1972. Those having experience earned $127 a week, slightly less than the average earnings for nonsupervisory workers in private industry, except farming.

In the Federal Government, the entrance salary for typists without experience was $104 a week in early 1973, compared with $132 a week for those with experience.

Working conditions for typists usually are similar to those of other office employees where they work. Typists sit for long periods and often must contend with high noise levels caused by machines located in the same area. (See the statement on Clerical Occupations for more information on working conditions and also for sources of additional information.)

COMPUTER AND RELATED OCCUPATIONS

Data processing needs have increased very rapidly over the past decade as population has grown, as business organizations have become more complex, and as scientific and technical knowledge has expanded. The computer has enabled us to keep pace with the increasing need for more and better information. Workers in computer and related occupations prepare data in the form necessary for machine processing, operate computer consoles and various related equipment, and analyze and interpret the machine's output.

Most computer careers require specialized training that varies widely in content and length depending upon the occupation. While there are no universal educational requirements for systems analysts and programmers, a college degree is increasingly important—especially for work in scientifically and technically oriented systems. Computer operators usually need at least a high school education; however, training and experience in operating the machine is more important than formal education.

All computer jobs, including those that generally require a college education, stress the importance of learning on the job. While this is the primary source of training for operating personnel, college graduates in computer science also may spend a year or more working on a system to learn how it functions.

In addition to technical knowledge and skills, computer personnel need good powers of concentration and should enjoy working with details. Those who operate equipment, for example, keypunchers or console operators, must have manual dexterity and some mechanical aptitude. Although programmers and systems analysts seldom run computer equipment, they also need mechanical ability to trace the source of data processing errors.

This chapter describes 3 computer occupations: Computer Operating Personnel, Programmers, and Systems Analysts.

ELECTRONIC COMPUTER OPERATING PERSONNEL

(D.O.T. 213.138, .382, .582, .588, and .885, and 223.387)

Nature of the Work

Computers require specialized workers to code "input," operate the console, and translate "output" into words and numbers. Although large systems require several workers, small ones need only one or two employees.

"Input" is data to be processed plus a programmer's step-by-step instructions to the computer. (Information about the occupation of Programer is given elsewhere in the *Handbook*.) In many systems, *keypunch operators* (D.O.T. 213.582) or *data typists* (D.O.T. 213.588) prepare input. Keypunch operators use machines similar to typewriters that punch holes in cards to represent specific items of information. Data typists use special typewriters to prepare input data which the machine converts to holes on cards or magnetic impulses on tapes.

Some computer systems get their input from "direct access" devices that use magnetic surfaces for recording data. These systems use machines called converters to transfer data from punched cards or paper tapes to the magnetic surface. *Card-to-tape converter operators* (D.O.T. 213.382) wire plugboards and interpret signals from a panel of lights on the machine. They also must understand the whole system to recognize errors in input or other situations that prevent proper operation.

Once facts and figures have been coded, data are ready to be processed. A *console operator* (D.O.T. 213.382) examines the programmer's instructions and makes sure the computer is loaded with tape, cards, or other input. The operator then starts the computer. During the processing, he manipulates switches and observes lights. If the computer stops or lights signal an error, the operator must locate the problem. Some operators who work with automatic systems do not start the computer each time a different problem is run. They must, however, watch the equipment carefully in order to respond to various machine signals.

Output is translated from machine language to words and numbers. In some systems, machines directly connected to the computer do this. In others, converters and high-speed printers run by auxiliary equipment operators—*tape-to-card converter operators* (D.O.T. 213.382) and *high-speed printer operators* (D.O.T. 213.382)—do this work. With the increasing use of telephone lines to transmit data, many auxiliary equipment operators run communications as well as computing equipment.

Places of employment

About 480,000 persons worked as

console, auxiliary equipment, and keypunch operators in 1972. Nearly three-fifths of all console and auxiliary equipment operators were men; women held 9 out of 10 keypunching jobs.

Jobs for operating personnel are found in all kinds of organizations, but they are most numerous in government agencies, insurance and public utility companies, banks, and factories. Large numbers also work for wholesale and retail stores, and for independent service organizations that process data for other firms.

Training, Other Qualifications, and Advancement

Employers often transfer operators of tabulating and bookkeeping machines to newly installed electronic computers. Other operators are recruited from the outside.

In hiring outsiders, private employers usually require a high school education. For console operators, some college training may be preferred. The Federal Government requires console and auxiliary equipment operators to be high school graduates unless they have specialized training or experience. Many employers give applicants special tests to determine their aptitude for computer work, especially the ability to reason logically.

Beginners usually receive training after they are hired. While auxiliary equipment operators train for a few weeks, console operators need a longer period of instruction. They attend classes to learn to mount tapes and operate the console. This classroom training is supplemented by instruction on the job, where operators become sufficiently familiar with the equipment to trace mechanical failures.

As they gain experience, operators work on more complex equipment. Eventually, they may be promoted to supervisors, or to jobs that combine supervision and console operation. Through on-the-job experience and additional study, some console operators qualify as programmers.

Computer operator positions tape.

Most employers prefer high school graduates for jobs as keypunchers. Although some organizations will train good typists in the operation of keypunching equipment, most seek workers who already have basic skills as keypunchers. Instruction in operating a keypunch machine is available in many high schools, public and private vocational schools, private computer schools, and numerous business schools and colleges. The Federal Government also sponsors programs to train unemployed and low-skilled workers for entry jobs as keypunch operators under provisions of the Manpower Development and Training Act and other legislation.

Although advancement opportunities for keypunch operators are limited, some are promoted to supervisory positions after several years on the job. With additional training, often including college study, a few keypunch operators advance to jobs as console operators.

Keypunch and auxiliary equipment operators should be able to work under close supervision and as part of a team. Operating personnel also must be skillful in working with things and not easily bored by repetitious tasks. Console operators frequently must exercise independent judgment, especially when working without supervision on second or third shifts.

Employment Outlook

Changes in technology will have different effects on the employment growth of occupations included in the group computer operating personnel.

Console and auxiliary equipment operators will grow rapidly over the period as new computers are installed and existing systems increase their capabilities. The demand for keypunch operators is not expected to keep pace with the growth in computer installations, however, because faster and more efficient methods of data entry will increasingly replace card punch equipment.

Earnings and Working Conditions

Beginning console operators averaged $127 a week in 1972, according to a recent Bureau of Labor Statistics survey in urban areas. Experienced console operators averaged $177 a week and experienced keypunch operators $125. Salaries of beginning operating personnel in the Federal Government are roughly comparable to those in private industry; in early 1973, they started at $132 a week. Console operators earned slightly more and keypunch operators slightly less than all nonsupervisory workers in private industry, except farming.

Some console and auxiliary equipment operators work evenings or nights because many computers run for two or three shifts. Tape librarians usually work on day shifts.

Because electronic computers are housed in carefully controlled temperatures, operators work in air-conditioned rooms. However, one disadvantage is the high level of noise generated by some auxiliary equipment. (See introduction to this chapter for additional information on Working Conditions.)

Sources of Additional Information

Further information on data processing careers is available from:

Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068.

For a list of reading materials giving information about computer operating personnel contact:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

PROGRAMMERS

(D.O.T. 020.188)

Nature of the Work

An electronic computer can process masses of information with great speed and accuracy, but the machine cannot think for itself. The programmer's job is to prepare step-by-step instructions for the computer to follow.

Before a computer can process a problem, exact and logical steps for its solution must be worked out. An experienced programmer or systems analyst does this preliminary work. (See the statement on Systems Analysts elsewhere in the *Handbook*.) Some programmers, whose work involves a considerable amount of this preliminary analysis, are known as programmer-analysts.

When this preliminary job is finished, the programmer prepares detailed instructions that tell the machine how to process the data. The way a "program" is written depends on the nature of the problem and the type of equipment to be used. The mathematical calculations involved in billing a firm's customers, for example, are different from those required in most scientific work. A business programmer works on instructions that tell the computer how to bill customers or make up a payroll. First the programmer decides what company records contain the information needed to prepare the documents. Next he makes a flow chart or diagram showing the computer what order to follow in doing each step. From the flow chart, the programmer writes detailed instructions telling the machine exactly what to do with each piece of information. He also prepares an instruction sheet for a computer operator to follow when the program is run. (The work of computer operators is described in the *Handbook* statement on Computer Operating Personnel.)

The final step in programming is a check to be sure that the programmer's instructions are correct and will produce the desired information. This check is called "debugging." The programmer uses a sample of the data to be processed to review what will happen as the computer follows instructions. He changes the instructions to take care of any errors that appear and has the computer make a trial run.

Because of differences in their work, many programmers specialize in either business or scientific applications. Some, known as systems or software programmers, write instructions that tell the computer how

to schedule jobs and when to switch from one to another. Although a simple program can be written in a few days, one designed to produce many different kinds of information may require a year or more. Often several programmers at different levels of responsibility work together under an experienced programmer's supervision.

Places of Employment

About 186,000 persons—about three-fourths of them men—worked as programmers in 1972. In addition, some professional workers such as engineers, economists, and accountants spend part of their time programming.

Most programmers work in large business organizations and government agencies. Large numbers also work for computer and other manufacturers and independent service organizations that furnish computer services for a fee.

Programmer explains instructions for processing data.

Training, Other Qualifications, and Advancement

There are no universal training requirements for programmers. Some are college graduates; others take special courses in computer work to supplement experience in a field such as accounting or inventory control.

Organizations that use computers for science and engineering prefer college graduates with degrees in the physical sciences, math, engineering, or computer science. Graduate degrees are required for some jobs. Very few scientific employers are interested in an applicant with no college training.

Many employers who use computers to process business records don't require college degrees, although college courses in data processing, accounting, and business administration are helpful. Some workers with no college training but experience in machine tabulation or payroll are promoted to programming jobs. They usually need additional courses in data processing before they are fully qualified programmers.

Interested persons can learn some of the necessary programming skills at a growing number of technical schools, colleges, and universities. Instruction ranges from introductory home study courses to advanced computer technology at the graduate level. High schools in many parts of the country also offer courses in computer programming.

In hiring programmers, employers look for people who have an aptitude for logical thinking and exacting analysis. The job also calls for patience, persistence, and the ability to work with extreme accuracy. Ingenuity and imagination are particularly important when programmers have to solve problems in new ways.

Beginning programmers usually attend training classes for a few weeks. Then they work on simple assignments while continuing with further specialized training. A programmer generally needs a year or more of experience before he can handle all aspects of his job without close supervision. Once he becomes skilled, his prospects for further advancement are good. In large organizations, workers may be promoted to lead programmers or systems analysts with supervisory responsibilities.

Employment Outlook

The employment of programmers will grow rapidly over the next decade as the number of computer installations increases. Thousands of job openings will become available each year due to growth and the need

to replace workers who leave the occupation. Because many programmers are young, relatively few job openings will be due to death or retirement.

The number of programmers will increase as business continues to automate processes once done by hand. For example, many stores will computerize credit information and their ordering and inventory of merchandise. Employment growth also will be sharp in computer service bureaus (organizations that furnish computer services for a fee). Substantial growth will continue in firms that were among the first to use computers on a large scale, including banks, insurance companies, and factories.

Although employment growth will be significant, programmers are not expected to multiply as rapidly as they have in the past for several reasons. Improved programming languages should make it easier for nonprogrammers to use machines, and preprogrammed mini-computers will be used for many applications. In addition, new techniques will enable the programmers to handle a greater volume of work. The best opportunities will be for experienced persons qualified in both programming and systems analysis who have kept up with the latest equipment and techniques.

Earnings and Working Conditions

Beginning business programmers averaged $8,500 a year in 1972, according to a Bureau of Labor Statistics survey in urban areas. Those in the North and West earned slightly more than the average while workers in the South earned a little less. Also programmers who worked for manufacturers and public utilities had higher earnings than those employed by banks and insurance companies.

Experienced business programmers averaged $11,000 a year, nearly twice as much as average earnings for all nonsupervisory workers in private industry, except farming. Lead programmers averaged $14,400 and managers of programming, $16,700 a year.

Federal government salaries are close to those in private industry. In early 1973, beginners started at $7,700 or $9,500; most experienced programmers earned from $11,600 to $18,900 a year.

Programmers work about 40 hours a week, but their hours are not always from 9 to 5. Once or twice a week a programmer may report early or work late to use the computer when it is available. Occasionally, they work on weekends or are telephoned to advise computer operators working a second or third shift.

Sources of Additional Information

Additional details about the occupation of programmer are available from:

Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068.

American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N.J. 07645.

For a list of reading materials on career opportunities in programming contact:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

SYSTEMS ANALYSTS

(D.O.T. 003.187, 012.168, 020.081 and 020.088)

Nature of the Work

Many essential business functions and scientific procedures rely on the work of systems analysts. Their job is to plan the activities needed for processing data to solve business, scientific, or engineering problems. Although a system can be developed to process data by hand, with office machines, or by computers, most analysts develop methods to use computers. This statement applies only to analysts who work on systems that use computers.

Systems analysts begin an assignment by determining the exact nature of the data processing problem. Often managers or subject matter specialists help them to do this. Then the analyst structures the problem logically, identifies all the data needed, and specifies how they are to be processed. Systems analysts may use various techniques in their work such as cost accounting, sampling, and mathematical model building. After analyzing the problem and devising a data processing system, they prepare charts and diagrams that describe how the system operates.

Analysts usually recommend which data processing equipment is to be used, and prepare instructions for programmers. (See the statement on Programmers in this chapter.) They also translate final results into terms that managers or customers can understand. Data processing problems are so varied and complex that many systems analysts specialize in one area. For example, analysts who work for scientific or engineering organizations may develop systems to determine the flight path of a space vehicle.

Systems analyst confers with programmer.

Others develop business systems for functions such as accounting, forecasting sales, or marketing research.

Some analysts improve systems already in use. They may develop better procedures or adapt the system to handle additional or different types of data. Others do research, described as advanced systems design, to devise new methods of systems analysis. These analysts usually have mathematical or engineering backgrounds.

Places of Employment

More than 100,000 persons—about 90 percent of them men—worked as systems analysts in 1972. Most analysts worked in urban areas for manufacturing concerns, insurance companies, banks, and wholesale and retail businesses. A growing number also are employed by universities and independent organizations that furnish computer services for a fee.

Training, Other Qualifications, and Advancement

There is no universally acceptable way of preparing for work in systems analysis. Some employers prefer applicants who have a bachelor's degree and experience in mathematics, science, engineering, accounting, or business. Others stress a graduate degree.

Educational preparation and experience often determine the kind of job opportunities available. For example, employers usually want an analyst who has a background in business administration for work in finance or one having an engineering background for a scientifically oriented system. Applicants also may qualify on the basis of professional experience in scientific, technical, or managerial occupations, or practical experience in data processing jobs such as programmer or computer operator. (See the statement on Computer Operators in this chapter.)

Most employers prefer people who have had some experience in computer programming. A beginner can learn to use electronic data-processing equipment on the job, or can take special courses offered by his employer, computer manufacturers, or colleges. In the Federal Government, for example, systems analysts usually begin their careers as programmers. After gaining some experience, they may be promoted to systems analyst trainees, and thus later qualify as systems analysts.

Systems analysts need an aptitude for logical thinking and should like working with ideas. Although they sometimes work as part of a team, much of their work is done independently. They should be able to concentrate and pay close attention to details.

In large data-processing departments, a person who begins as a junior systems analyst and gains experience may be promoted to senior or lead systems analyst. Systems analysts who show leadership ability also can advance to jobs as managers of systems analysis or data-processing departments.

Employment Outlook

Employment of systems analysts is expected to grow very rapidly through the mid-1980's as data processing systems in business and Government expand. In addition to opportunities that result from

growth, some openings will occur as systems analysts advance to more responsible positions or leave their jobs to enter other employment. Because many of these workers are young, relatively few positions will result from retirement or death.

Among the factors expected to contribute to a growing demand for systems analysts are the extension of computer technology to small businesses and the growth of computer centers to serve individual clients for a fee. Employment also will be stimulated by efforts to develop systems that will retrieve information more efficiently, and to monitor industrial processes.

Earnings and Working Conditions

Beginning systems analysts averaged $11,800 a year in 1972, according to a private survey which covered more than 85,000 workers in business and government data-processing installations in all parts of the country. Earnings of experienced systems analysts averaged $15,700 annually; in some cases they were paid $25,000 or more a year. Systems analysts earn over twice as much as the average for all nonsupervisory workers in private industry, except farming.

Systems analysts usually work about 40 hours a week—the same as other professional and office workers. Unlike many computer operators who work evening or night shifts, systems analysts generally work only during the day. Occasionally, evening or weekend work may be necessary to complete emergency projects.

Sources of Additional Information

Additional information about the occupation of systems analyst is available from:

American Federation of Information Processing Societies, 210 Summit Avenue, Montvale, N.J. 07645.

Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068.

For a list of reading materials on career opportunities in the data processing field write:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

BANKING OCCUPATIONS

Modern banks offer a variety of services to meet the needs of their customers. They provide checking and savings accounts, loans, trust fund management, and financial counseling.

Bank work is highly specialized, and most employees gain experience and skill through on-the-job training. Although banks usually seek college graduates for officer trainee jobs, many opportunities exist for high school graduates as well. Banks also give many workers opportunities to qualify for better positions if they enroll in programs offered by the American Institute of Banking, or if they take finance and business courses in colleges and universities.

Bank employees should enjoy working with numbers and be able to perform detailed work. Personal qualifications such as honesty and the ability to meet and communicate with customers are important.

This section discusses 3 office occupations unique to banking: Clerks, Tellers, and Officers.

BANK CLERKS

(D.O.T. 209.388, 210.388, 215.388, 217.388, 219.388 and .488)

Nature of the Work

All complex organizations require the processing of large amounts of paperwork. Because of the specialized nature of banking, some of the duties of bank clerks differ from those of clerks in other businesses. (Secretaries, office machine operators, receptionists, and other clerical workers whose jobs are much the same in banks as in other businesses are discussed elsewhere in the *Handbook*.)

In a small bank, one clerk may do several jobs such as sort checks, total debit and credit slips, and prepare monthly statements for depositors. In a large bank, however, each clerk usually specializes and frequently has a special job title.

Bank clerks known as *sorters* (D.O.T. 219.388) separate documents—checks, deposit slips, and other items—into different groups and tabulate each "batch" so they may be charged to the proper accounts; often they use canceling and adding machines in their work. Many banks also employ *proof machine operators* (D.O.T. 217.388), who use equipment that sorts items and adds and records the amount of money involved.

The bookkeeping workers who keep records of depositors' accounts, and of bank transactions such as loans or the purchase and sale of securities, are the largest single group of bank clerks. *Bookkeeping machine operators* (D.O.T. 215.388) may use conventional bookkeeping machines or electronic posting machines to record financial trans-

Bank clerks record financial transactions.

actions. In banks, these workers are sometimes known as account clerks, posting machine operators, or recording clerks. *Bookkeepers* (D.O.T. 210.388) job titles relate to the kinds of records they keep—for example, Christmas club bookkeeper, discount bookkeeper, interest-accrual bookkeeper, trust bookkeeper, and commodity loan clerk. Thousands of *bookkeeping and accounting clerks* (D.O.T. 219.488) also do routine typing, calculating, and posting. Included in this group are reconcilement clerks, who process statements from other banks to aid the auditing of accounts; and trust investment clerks, who post the daily investment transactions of bank customers.

Other clerical employees whose duties and job titles are unique to banking include *country collection clerks* (D.O.T. 219.388), who sort thousands of pieces of mail daily and determine which items must be held at the main office and which should be routed to branch banks for collection. Also employed are *transit clerks* (D.O.T. 217.388), who sort checks and drafts on other banks, list and total the amounts involved, and prepare documents to be mailed for collection; *exchange clerks* (D.O.T. 219.388), who service foreign deposit accounts and determine charges for cashing or handling checks drawn against such accounts; *interest clerks* (D.O.T. 219.388), who keep records on interest-bearing items that are due to or from the bank; and *mortgage clerks* (D.O.T. 209.388), who type legal papers dealing with real estate upon which money has been loaned, and maintain records relating to taxes and insurance on these properties.

Electronic data-processing has created several new clerical occupations which are unique to banking. These include the electronic reader-sorter operator who runs electronic check sorting equipment; the check inscriber or encoder who operates machines that print information on checks and other documents in magnetic ink to prepare them for machine reading; and the control clerk who keeps track of the large volume of documents flowing in and out of the computer division. Other occupations include card-type converter operator, coding clerk, console operator, data typist, data converting machine operator, data examination clerk, high speed printer operator, tape librarian, teletype operator, and verifier operator.

Most of the 475,000 clerical employees in banks in 1972 were women.

Training, Other Qualifications, and Advancement

High school graduation is adequate preparation for most beginning clerical jobs in banks. Courses in bookkeeping, typing, business arithmetic, and office machine operation also are desirable. Applicants may be given brief tests to determine their ability to work rapidly and accurately, and to communicate effectively with others. They should be able to work as part of a team and under close supervision.

Beginners may be hired as file clerks, keypunch operators, transit clerks, clerk-typists, or for related work. Some are trained by the bank to operate various office machines. A few start as inside messengers.

A clerk in a routine job may be promoted to a minor supervisory position to teller or credit analyst, and eventually to senior supervisor. Opportunities for advancement to bank officer positions also exist for outstanding clerks who have had college training or have taken specialized courses in banking.

Additional education obtained during one's employment—particularly the courses offered by the American Institute of Banking—may help workers advance. (See statement on the Banking Industry for further information on the Institute's educational program.)

Employment Outlook

Employment of bank clerks is expected to increase rapidly through the mid-1980's. New jobs created by growth, as well as replacements for those who retire, die, or stop working for other reasons, probably will result in thousands of openings each year. Replacement needs are relatively high in banks, as in other industries which employ many women in clerical positions.

Jobs for clerks will arise as established banks expand their services and new banks are opened. In banks that install electronic equipment, however, fewer opportunities can be expected for check sorters and bookkeeping machine operators. Most workers affected by the shift to computer processing will be retrained and reassigned, either to new jobs created by the change in equipment and methods, or to other duties related to new banking services. Overall, the volume of work is expected to be so great that the total number of clerks will continue to rise for some years to come. Occupations related to electronic data processing will have the most rapid growth.

Earnings

According to a Bureau of Labor Statistics survey, clerical workers in financial institutions, including banks, usually earned between $87 and $150 a week in 1972.

Experienced tabulating machine operators and secretaries received the highest weekly salaries: about $150. The earnings of beginning file clerks and messengers were generally the lowest: $87 and $89 a week.

Bank clerks are covered under the Fair Labor Standards Act, a Federal law which provides for a minimum wage. In 1972, the minimum was $1.60 an hour; thus, any clerk who worked a 40-hour week earned at least $64.

See statement on the Banking Industry for information on Places of Employment and Sources of Additional Information; and for additional information on Training, Employment Outlook, and Earnings and Working Conditions.

Branch bank manager helps new customers open checking account.

BANK OFFICERS

(D.O.T. 186.118, .138, .168, and .288; 161.118, 189.118 and .168)

Nature of the Work

Practically every bank has a president who directs operations; one or more vice presidents who act as general managers or have charge of bank departments such as trust, or credit; and a comptroller or cashier who, unlike cashiers in stores and other businesses, is an executive officer generally responsible for all bank property. Large banks also may have treasurers and other senior officers, as well as junior officers, to supervise the various sections within different departments. Banks employed almost 220,000 officers in 1972; women were about one-sixth of the total.

A bank officer makes decisions within a framework of policy set by the board of directors and existing laws and regulations. An officer must have a broad knowledge of business activities to relate to the operations of his department. For example, loan officers evaluate the credit and collateral of individuals and businesses applying for a loan. Similarly, trust officers must understand each account before they invest funds to support families, send young people to college, or pay retirement pensions. Besides supervising financial services, officers advise individuals and businessmen and participate in community projects.

Because banks offer many services, a wide choice of careers is available to those who specialize.

Loan officers must be familiar with economics, production, distribution, merchandising, and commercial law. They also need to know business operations and be able to analyze financial statements. Officers may handle installment, commercial, real estate, or agricultural loans.

Trust management requires knowledge of financial planning and investment for investment research and estate and trust administration.

Operations officers plan, coordinate, and control the work flow; update systems; and strive for bank efficiency. They also train and supervise a large number of people. Careers in bank operations include electronic data processing and internal and customer services.

A correspondent bank officer is responsible for relations with other banks; branch bank manager, for all functions of a branch office; and an international officer, for advising customers with financial dealings abroad. A working knowledge of a foreign country's language, geography, politics, history, and economic growth can help those interested in international banking.

Other career fields for bank officers are auditing, economics, personnel administration, public relations, and operations research.

Training, Other Qualifications, and Advancement

Bank officer positions are filled by management trainees or by promoting outstanding bank clerks. College graduation usually is required for management trainees. A business administration major in finance or a liberal arts curriculum including accounting, economics, commercial law, political science, and statistics serve as excellent preparation for officer trainee positions. Valuable experience may be gained through summer employment programs.

Many banks have well-organized officer-training programs usually ranging from 6 months to 1 year. Trainees may start as credit or investment analysts or rotate among bank departments to get the "feel" of banking; bank officials then can determine the position for which each employee is best suited.

Although persons planning to become bank officers should like to work independently and analyze detailed information, they need tact and good judgment in order to counsel customers.

Advancement to officer may come slowly in small banks where the number of positions is limited. In large banks that have special training programs, promotions may come more quickly. For a senior officer position, however, an employee usually needs many years of experience.

Although experience, ability, and leadership are emphasized for promotion, advancement also may be accelerated by special study. Courses in every phase of banking are offered by the American Institute of Banking, a long-established, industry-sponsored school. (See the statement on the Banking Industry elsewhere in the *Handbook* for more information on the Institute's program and other training programs sponsored by universities and local bankers' associations.)

Employment Outlook

Through the mid-1980's, employment of bank officers is expected to increase rapidly. Computers will be used to expand banking activities; additional officers will be required for sound management and control and to replace those who retire or leave their jobs for other reasons.

Although college graduates who meet the standards for executive trainees should find good opportunities for entry positions, many senior officer positions will be filled by promoting people already experienced in banking. Competition for these promotions, particularly in large banks, is likely to be keen.

Earnings

According to a private survey conducted in 1972, large banks, insurance companies, and other financial institutions paid salaries ranging from $550 to $780 a month to new executive trainees who were college graduates.

The salaries of senior bank officers may be several times as great as these starting salaries. For officers, as well as for other bank employees, earnings are likely to be lower in small towns than in big cities.

See the statement on the Banking Industry elsewhere in the *Handbook* for Places of Employment and Sources of Additional Information, and for general information on banking occupations.

TELLERS

(D.O.T. 212.368)

Every bank, no matter how small, has at least one teller who receives and pays out money and records these transactions. In a very small bank, one *all-round teller* may handle all transactions; in larger banks different kinds of transactions usually are assigned to different tellers. For example, a *Christmas Club* teller accepts and records deposits made to Christmas Club savings accounts and a *note teller* handles certain transactions for clients who have made loans. Other tellers who have special job titles include *commercial* (or *paying and receiving*), *savings*, *foreign exchange*, *payroll*, *discount*, and *securities tellers*.

Bank tellers should possess a pleasant personality.

Commercial tellers, the most common, cash customer's checks and handle deposits and withdrawals from checking and savings accounts. Before cashing a check, the teller must verify the identity of the person to whom payment is made, and must be certain that the payee's account has sufficient funds to cover the payment. When accepting a deposit, the teller checks the accuracy of the deposit slip and enters the total in a passbook or on a deposit receipt. Tellers may use machines for making change and for totaling deposits. Those who handle savings accounts may use a "window" posting machine to print a receipt, record the transaction in the customer's passbook, and simultaneously post the transaction to the bank's ledger.

After banking hours, tellers count cash on hand, list the currency-received tickets on a settlement sheet, and balance the day's accounts. They also sort checks and deposit slips. Paying and receiving tellers may supervise one or more clerks.

About 250,000 tellers were employed in 1972. A large number worked part time; about 9 out of 10 were women.

Training, Other Qualifications, and Advancement

In hiring tellers, banks prefer high school graduates experienced in clerical work. Maturity, neatness, tact, and courtesy are important, because customers deal with tellers far more frequently than with other bank employees. Since tellers handle large sums of money and are bonded, they must meet the standards established by bonding companies. Although tellers work independently, their recordkeeping is closely supervised. They work with detail and are confined to a small work area.

New tellers usually observe experienced workers for a few days before doing the work themselves. Training may last from a few days to 3 weeks or longer. Beginners usually start as commercial tellers; in large banks which have a separate savings teller's "cage," they may start as savings tellers.

After gaining experience, a competent teller in a large bank may advance to head teller; those who have had some college or specialized training offered by the banking industry may be promoted to officers. (See the statement on the Banking Industry for information about the educational programs of the American Institute of Banking.)

Employment Outlook

The number of bank tellers is expected to increase rapidly through the mid-1980's as banks expand their services. An increasing proportion of tellers, however, will work part-time during peak hours to accommodate customers who transact business during the noon hour and evenings. Thousands of openings will occur each year as a result of employment growth and the need to replace tellers who retire, die, or stop working for other reasons. Replacement needs are relatively high for the many thousands of women tellers.

Although increased use of mechanical and electronic equipment may eliminate some routine duties and speed other work, total employment is unlikely to be adversely affected.

Earnings

According to a Bureau of Labor Statistics survey, all nonsupervisory workers in banking, including tellers, averaged $112 a week in 1972. The range between the lowest and highest salaries depends on experience, the worker's specific duties, and location and size of the bank.

Bank tellers are covered under the Fair Labor Standards Act, a Federal law which provides for minimum wages. In 1972, the minimum was $1.60 an hour; thus, tellers who worked a 40-hour week earned at least $64.

See the statement on the Banking Industry elsewhere in the *Handbook* for Places of Employment and Sources of Additional Information, and for general information on banking occupations.

INSURANCE OCCUPATIONS

Insurance protection has become an integral part of the American way of life. It frees policyholders and their beneficiaries from worry and financial burdens that may result from death, illness, or other losses beyond their control. Businesses could not operate, nor could most people buy homes or other major items, without the assurance of protection from sudden disaster. Insurance workers adapt policies to meet changing needs, decide which applications can be accepted and establish premium rates on the policies, and investigate and settle claims.

A college degree is increasingly important for professional, technical, and managerial jobs in insurance, although some positions are open to high school graduates who have appropriate experience. Insurance workers in clerical positions need a high school diploma. Regardless of their previous training, insurance workers must continually learn while on the job to develop their potential. Many professional associations sponsor courses in all phases of insurance work; employees are encouraged to participate to prepare themselves for more responsible jobs.

This section describes 4 insurance occupations: Actuaries, Claim Adjusters, Claim Examiners, and Underwriters. (Statements on the Insurance Industry and Insurance Agents and Brokers are included elsewhere in the *Handbook*.)

ACTUARIES

(D.O.T. 020.188)

Nature of the Work

Why do young persons pay more for automobile insurance than older persons? How much should an insurance policy cost? Answers to these and similar questions are provided by actuaries who design insurance and pension plans that can be maintained on a sound financial basis. They assemble and analyze statistics to calculate probabilities of death, sickness, injury, disability, unemployment, retirement, and property loss from accident, theft, fire, and other potential hazards. Actuaries use this information to determine the expected insured loss. For example, they may calculate how many persons who are 21 years old today will live to age 65—the possibility that an insured person might die during this period is a risk to the company. They then calculate a price for assuming this risk that will be profitable to the company yet be competitive with other insurance companies. Finally, they must make sure that the price charged for the insurance will enable the company to pay all claims and expenses as they occur. In the same manner, the actuary calculates premium rates and policy contract provisions for each type of insurance offered. Most actuaries specialize in either life and health insurance or in property and liability (casualty) insurance.

To perform their duties effectively, actuaries must keep informed about general economic and social trends, and legislative, health, and other developments that may affect insurance practices. Because of their broad knowledge of insurance, actuaries may work on problems arising in investment, underwriting, group insurance, and pension sales and service departments. Actuaries in executive positions help determine general company policy. In that role, they explain complex technical matters to a variety of laymen, company executives, and government officials. They also may testify before public agencies on proposed legislation affecting the insurance business, or justify intended changes in premium rates or contract provisions.

Actuaries who work for the Federal Government usually deal with a particular insurance or pension program, such as social security or life insurance for veterans and members of the Armed Forces. Actuaries in State government positions regulate insurance companies, supervise the operations of State retirement or pension systems, and work on problems connected with unemployment insurance or workmen's compensation. Consulting actuaries set up pension and welfare plans and make periodic evaluations of these plans for private companies, unions, and government agencies.

Places of Employment

Approximately 5,500 persons worked as actuaries in 1972. About one-half of all actuaries worked in the three states that are the major centers of the insurance industry — New York, Connecticut, and Illinois.

Over two-thirds of all actuaries worked for private insurance companies. Most worked for life insurance companies; the rest worked for property and liability (casualty) companies. The number of actuaries

employed by an insurance company depends on the volume of its business and the number and types of insurance policies it offers. Large companies may employ over 100 actuaries; small firms may have only a few actuaries on their staffs or rely instead on rating bureaus or consulting firms.

Consulting firms and rating bureaus (associations that supply actuarial data to member companies) employed about one-fifth of all actuaries. Other actuaries work for private organizations administering independent pension and welfare plans or for Federal and State government agencies. A few teach in colleges and universities.

Training, Other Qualifications, and Advancement

The minimum requirement for beginning jobs in actuarial work is a bachelor's degree with a major in mathematics, statistics, economics, or business administration and a thorough foundation in calculus, probability, and statistics. Other desirable courses are insurance law, economics, and accounting. Although only 17 colleges and universities offer training specifically designed for actuarial careers, several hundred schools offer some of the necessary courses.

It usually takes from 5 to 10 years after beginning an actuarial career to complete the entire series of examinations required for full professional status. These examinations cover general mathematics, specialized actuarial mathematics, and all phases of the insurance business. Those considering an actuarial career should take at least the beginning examination covering general mathematics while still in college. Success in passing the first two examinations helps beginners to evaluate their potential as actuaries.

Actuaries receive on-the-job training.

Those who pass these examinations usually have better opportunities for employment and receive a higher starting salary. Advanced examinations, usually taken by those in junior actuarial positions, require extensive home study and experience in insurance work.

The Society of Actuaries gives 10 actuarial examinations for the life insurance and pension field; and the Casualty Actuarial Society gives 9 for the property and liability (casualty) field. Since the first parts of the examination series of either Society are the same, students may defer the selection of their insurance specialty until they become more familiar with the field. Persons who complete five examinations in either field are awarded "associate" membership in the society. Those who have passed an entire series receive the title "fellow".

Beginning actuaries often rotate among different jobs to learn various actuarial operations and to become familiar with different phases of insurance work. At first, their work may be rather routine, such as preparing calculations or tabulation for actuarial tables or reports. As they gain experience, they may supervise actuarial clerks, prepare

correspondence and reports, and do research.

Advancement to more responsible work as assistant, associate, and chief actuary depends largely on job performance and the number of actuarial examinations passed. Many actuaries, because of their broad knowledge of insurance and related fields, are selected for administrative positions in other company activities, particularly in underwriting, accounting, or data processing departments. Some actuaries advance to top executive positions.

Employment Outlook

Employment of actuaries is expected to rise very rapidly through the mid-1980's. In addition to job openings resulting from this growth, several hundred actuaries will be needed each year to replace those who retire, die, or transfer to other occupations. Job opportunities should be favorable for new college graduates who have passed one or two of the actuarial examinations while still in school and have a strong mathematical and statistical background. However, because of the large number of persons expected to receive degrees in mathematics, and the increasing number of students taking actuarial examinations, competition for beginning jobs could intensify.

A more affluent and insurance-conscious population and business community will demand a rising number and variety of insurance policies. There will be a need for actuaries to solve the growing number of problems arising from continuously rising, and increasingly complex insurance and pension coverage. The growing number of group health and life insurance plans and of pension and other benefit plans will require actuarial services. Government regulatory agencies will need additional actuaries. The wide-spread use of electronic computers has also made more actuarial studies possible, and there will be a need for actuaries capable of working with electronic computers.

New State and Federal legislation, such as no-fault automobile insurance, competitive rating, and pension reform may be passed, and make more actuarial studies necessary.

Earnings and Working Conditions

In 1972, actuaries had average salaries over three times as high as the average for non-supervisory workers in private industry, except farming. Depending on their college grades and experience, new college graduates entering the field as trainees earned from about $8,000 to $10,000 a year. Most insurance companies paid $300 to $800 a year more to trainees who had completed their first actuarial examination, and another $300 to $800 when they completed the second examination.

In the Federal government, new graduates with the bachelor's degree could start at $7,694 or $9,520 a year in early 1973, depending on their college grades. Those with the master's degree could start at $9,520 or $11,614.

Beginning actuaries can look forward to a marked increase in earnings as they gain professional experience and successfully complete either society's series of examinations. Insurance companies give merit increases to those who pass one or a group of examinations. Fellows of either the Society of Actuaries or the Casualty Actuarial Society earn over $18,000 a year and many actuaries earn more than $25,000 a year. Those in executive positions in large companies may earn over $35,000.

Sources of Additional Information

For facts about acuarial opportunities and qualifications contact:

Casualty Actuarial Society, 200 East 42nd St., New York, N.Y. 10017

Society of Actuaries, 208 South LaSalle St., Chicago, Ill. 60604.

CLAIM ADJUSTERS

(D.O.T. 191.268, 241.168)

Claim adjusters investigate, negotiate, and settle claims made against an insurance company by policyholders who have suffered loss. Most adjusters work for companies that sell property and liability insurance, although some handle claims arising under accident or health insurance policies. (See the statement on Claim Examiners for a discussion of claim settlement in life insurance.)

When an insurance company receives a claim, the adjuster determines the amount of the loss and whether the policy covers it. Adjusters use reports, physical evidence, and testimony of witnesses in investigating a claim. When their company is liable, they negotiate with the claimant and settle the case.

Adjusters make sure that settlements are in line with the real extent of the loss. They must protect their company from false or inflated claims but, at the same time, settle valid claims fairly and promptly. Some adjusters are allowed to issue checks on company funds; others submit their findings to the insurance company which then pays the claimant.

Some adjusters work with all lines of insurance. Others specialize in claims from property damage by

fire, marine losses, automobile damage, workmen's compensation losses, or bodily injury. Some States have no-fault insurance plans that relieve the adjuster from determining responsibility for a loss. Adjusters who work in these States, however, still must decide the true amount of a loss. For some minor property damage cases, the insured parties submit estimates of repair costs. For other claims, adjusters personally inspect the damage and make a brief investigation.

Adjusters work mostly away from the office. They may be called to the site of an accident or to the location of a fire or burglary. Adjusters make their own schedules of the activities needed to dispose of a claim properly. They also keep written or taped records of information obtained from witnesses and other sources, and prepare reports of their findings.

Claim adjuster discusses automobile damage with a policyholder.

Places of Employment

About 128,000 persons—most of them men—were claim adjusters in 1972. Adjusters work for insurance companies, adjustment bureaus (organizations formed by several insurance companies to settle claims), and independent adjusting firms. Some contract their services privately for a fee.

A few public adjusters represent the insured rather than the insurance company. These adjusters usually are retained by banks, financial organizations, and other business firms to handle fire and other losses to property. They negotiate claims against insurance companies and deal with adjusters for such companies.

Adjusters can look forward to working in almost any area of the United States, since claims must be settled locally in all parts of the country. Occasionally, the adjuster may travel to the scene of a disaster, such as a hurricane or a riot, to work with local personnel. Some cases result in travel outside the United States.

Training, Other Qualifications, and Advancement

Although a growing number of firms require claim adjusters to have a college degree, many hire those without college training, particularly if they have specialized experience. For example, a person experienced in automobile repair work may qualify as an auto adjuster. However, an adjuster who lacks college training probably will be slower in advancing to senior or supervisory positions.

No specific field of college study is recommended; many successful adjusters have liberal arts backgrounds. An adjuster who has a business or accounting background might specialize in loss from business interruption or damage to merchandise. Those with college training in engineering or law will find their education helpful in adjusting bodily injury claims. Legal training is desirable, although few employers demand that beginning adjusters have a law degree.

Nearly three-fourths of the States and Puerto Rico require adjusters to be licensed. Despite wide variation among State licensing requirements, applicants usually must comply with one or more of the following: pass a written examination covering the fundamentals of adjusting; furnish character references; be 20 or 21 years of age and fulfill State residency qualifications; offer proof that they have completed an approved course in insurance or loss adjusting; and file a surety bond.

Many insurance companies and adjustment firms offer on-the-job training and home study courses for beginning adjusters. The Insurance Institute of America offers a six-semester study program leading to a diploma in insurance loss and claim adjusting upon successful completion of six examinations. Adjusters can prepare for these examinations by independent home study, through company or public classes, or by college courses in insurance. A professional Certificate in Insurance

Adjusting also is available from the College of Insurance in New York City.

Because they work closely with claimants, witnesses, and policyholders, adjusters must be able to adapt to many different persons and situations. They should be able to gain the respect and cooperation of people from different backgrounds. When an adjuster's evaluation of a claim differs from that of the person who has suffered the loss, he should be able to explain his conclusions tactfully. Successful adjusters must be observant and pay careful attention to details.

Most adjuster trainees are assigned to field offices or urban training centers operated by some insurance companies for an orientation course in general insurance principles. Beginners work on small claims under the supervision of an experienced adjuster. As they learn more about claim investigation and settlement, they are assigned claims that are higher in loss value and more difficult.

Adjusters may be promoted to senior or chief adjuster when they demonstrate competence in handling assignments and progress in available study courses. The adjuster who shows administrative skills may advance to claim supervisor in a field office; senior adjusters who are able to organize workflow and make decisions may be promoted to managerial positions in the field or home office. Adjusters with legal backgrounds can advance to trial attorney or home office legal manager.

Employment Outlook

Employment of claim adjusters is expected to grow moderately through the mid-1980's as the number of insurance claims continues to increase. In addition to jobs created by growth of the occupation, many others will result from the need to replace workers who die, retire, or transfer to other jobs.

Several factors point to a growing volume of insurance and a resulting need for claim adjusters. Higher personal incomes should stimulate property and liability sales as families insure homes, additional automobiles, and other consumer durables. Expanding businesses will need protection for new plants and equipment and for insurance covering workmen's compensation and product liability. As more people live and work in densely populated areas, the increased risk of automobile accident, fire, or theft should result in a greater number of claims.

Growth of this occupation may be slower than in recent years as no-fault plans enable adjusters to handle more cases. Independent adjusters who specialize in automobile damage claims may suffer some loss of business. Prospects are best for adjusters who specialize in other types of claims or those who can move into other lines of adjusting.

Earnings and Working Conditions

According to an American Insurance Association/American Mutual Insurance Alliance survey of companies that sell property and liability insurance, all-lines adjusters averaged $10,000 a year in 1972.

Adjusters with supervisory responsibilities averaged $13,000; some earned over $20,000 a year. Most public adjusters are paid a percentage of the amount of the loss adjustment—generally 10 percent. Adjusters may be furnished company cars or reimbursed for use of their own vehicles during business hours. Salaries of claim adjusters are above the average earnings for nonsupervisory workers in private industry, except farming.

Claim adjusting is not a desk job. It requires that a person be physically fit because much of the day may be spent in driving from one place to another, walking about outdoors, and climbing stairs. Adjusters may have to work evenings or weekends in order to interview witnesses and claimants when they are available. Since most companies provide 24-hour claim service to their policyholders, some adjusters always must be on call. (See the statement on the Insurance Industry for additional information on working conditions and employee benefits.)

Sources of Additional Information

Information about licensing requirements for claim adjusters may be obtained from the department of insurance in each State. General information about a career as a claim adjuster is available from the home offices of many property and liability insurance companies. Information about career opportunities as a claim adjuster also may be obtained from:

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

Information about public insurance adjusting is available from:

National Association of public Adjusters, 1613 Munsey Building Baltimore, MD. 21202.

CLAIM EXAMINERS

(D.O.T. 168.288 and 249.268)

Nature of the Work

Although policyholders expect their insurance claims to be paid promptly, important questions often must be answered first. These

questions may arise when large settlements are made by property/liability company adjusters, when a false claim is suspected, or as regular procedure when a claim exceeds a specified amount. Claim examiners, also called claim representatives or claim reviewers, investigate details of the claim to provide answers for these questions.

Life insurance claim examiners may check claim applications for completeness and accuracy, interview medical specialists, consult policy files to verify information on a claim, or calculate benefit payments. They are authorized to investigate and approve payment on all claims up to a certain limit; larger claims are referred to a senior examiner.

In property/liability companies, the claim examiner reviews claims to be sure that the adjusters, who do most of the investigative work, have followed proper procedures. (See the statement on Claim Adjusters elsewhere in the *Handbook*.) Some property/liability firms employ workers to examine and settle small claims only, such as those arising over minor automobile damage. These claim workers, called "inside adjusters," contact claimants by telephone or mail and have the policyholder send repair costs, medical bills, and other statements to the company.

In both life and property/liability companies, some home office examiners process only unusual or questionable claims referred from regional or field offices.

Claim examiners need a thorough knowledge of their company's settlement procedures and basic policy provisions. Although they can consult company claim manuals, efficient examiners must be familiar with procedures so that frequent checking is unnecessary. Besides verifying claims and approving payment, claim examiners maintain records and prepare reports to be submitted to their company's data processing department.

Examiner discusses insurance claims with policyholder.

Examiners checking incorrect or questionable claims may correspond with investigating companies, field managers, agents, and policyholders. Claim examiners occasionally travel to obtain information by a personal interview, or contact State insurance departments and other insurance companies. Experienced examiners serve on committees, conduct surveys of claim practices within their company, and help devise more efficient ways to process claims. They also may appear in court to testify on contested claims.

Places of Employment

About 29,000 persons—half of them women—worked as claim examiners in 1972. Most worked for life insurance companies in large cities such as New York, Hartford, Chicago, San Francisco, and Dallas, where home or regional offices are located. Some were employed in field offices in smaller cities and towns where their companies sell and service insurance policies.

Training, Other Qualifications, and Advancement

Although many employers prefer college graduates for claim examiner positions, some firms accept applicants with good high school records if they have experience in clerical work or some college training. The employee who has only a high school education may begin as a claim processor in a group life or health insurance department. College graduates, or those having 2 years or more of college training, usually begin work as junior claim ex-

aminers. Although courses in insurance, economics, or other business subjects are helpful, a major in almost any college field is adequate preparation.

The beginning claim examiner is given on-the-job training under the direction of an experienced claim manager. Trainees who are college graduates also may receive instruction in insurance fundamentals or personnel management designed to prepare them for more responsible jobs. The Life Office Management Association (LOMA) cooperates with the International Claim Association in offering a claims education program for life and health insurance claim examiners. The program is part of the LOMA Institute Insurance Education Program leading to the professional designation of FLMI (Fellow, Life Management Institute) upon successful completion of eight written examinations. Most insurance companies encourage study by making educational materials available to employees enrolled in the LOMA Institute Program. Many firms offer classroom intruction in preparation for the annual examinations.

Because they have frequent contact with agents and brokers, field managers, and policyholders, claim examiners must be able to communicate effectively in many different situations. In addition, they need to be familiar with medical and legal terms and practices and Federal and State insurance laws and regulations. Because the claim examiner may have to check premium payments, policy values, and other numerical items in processing a claim, some skill in performing mathematical calculations is an asset. They also should have a good memory and enjoy working with details.

College trained workers usually can be promoted to claim examiner or senior claim representative after one year; workers who lack formal academic training generally advance more slowly. Examiners who show unusual competence in claim work sometimes are promoted to claim approver or another supervisory job within the claim department. Qualified examiners also can advance to jobs in underwriting, data processing, or administration.

Employment Outlook

Employment of claim examiners is not expected to increase through the mid-1980's. Some job openings will occur, however, as examiners die, retire, or transfer to other work. Competition for the few supervisory openings is expected to be keen.

Although the volume of insurance should continue to expand, computers will enable each examiner to process more claims, especially routine ones and those that arise under group life and health policies. In addition, as smaller branch offices are consolidated, companies will be able to handle the rapidly expanding volume of claims with a relatively stable work force.

Earnings and Working Conditions

College graduates hired by life insurance companies as claim examiner trainees averaged $8,000 a year in 1972, according to a Life Office Management Association survey. Supervisors of claims earned $11,500 to $17,300 a year. In most cases, examiners in large companies earned higher salaries.

An American Insurance Association/American Mutual Insurance Alliance survey of property/liability insurance companies showed that in 1972 "inside adjusters" averaged $7,500. Claim supervisors averaged $13,000; some earned over $20,000 a year. Salaries of claim examiners who are not supervisors are slightly above the average for all nonsupervisory workers in private industry, except farming.

Claim examiners have desk jobs that require no unusual physical activity. Although the average work week for examiners is 35 to 40 hours, they may work longer at times of peak claim load or when quarterly and annual statements are prepared. They also may need to travel occasionally. (See the statement on the Insurance Industry for additional information on working conditions and employee benefits.)

Sources of Additional Information

General information about a career as a claim examiner is available from the home office of many life insurance and property/liability insurance companies and also from:

Institute of Life Insurance, 277 Park Ave., New York, N.Y. 10017.

Insurance Information Institute 110 William St., New York, N.Y. 10038.

UNDERWRITERS

(D.O.T. 169.188)

Nature of the Work

Insurance companies assume millions of dollars in risks each year, by transferring chance of loss from their policyholders to themselves. Underwriters appraise and select the risks their company will insure. (The term underwriter sometimes is used in referring to insurance salespeople; see the statement on Insurance Agents and Brokers elsewhere in the

Handbook for a discussion of that occupation.)

An underwriter decides if his company will select a risk after analyzing information in insurance applications, reports of safety engineers, and actuarial studies (reports that describe the probability of insured loss). Some routine applications that require very little independent judgment are handled by computers. Generally, however, underwriters use considerable personal judgment in making decisions. Because these decisions are seldom reviewed at a higher level, the underwriter has great responsibility. His company may lose business to competitors if he appraises risks too conservatively or have to pay many future claims if his underwriting actions are too liberal.

When deciding that a policy is an acceptable risk, an underwriter may outline the terms of the contract, including the amount of the premium. Underwriters frequently correspond with policyholders, agents, and management about policy cancellations or information requests. In addition, they sometimes accompany salespeople on appointments with prospective customers. Some underwriters in small companies issue policies or supervise the sales force.

Most underwriters specialize in one of three major categories of insurance: life, property and liability, or health. Life underwriters may further specialize in one or more types of life insurance, such as group or individual policies. The property and liability underwriter specializes by type of risk insured, such as fire, automobile, marine, or workmen's compensation. Some underwriters, called commercial account underwriters, handle business insurance exclusively. They must evaluate a firm's entire operation in appraising its insurance application.

Underwriter discusses information on an insurance application.

A group insurance policy insures all persons in a specified group through a single contract. The group underwriter analyzes the overall composition of the group to be sure that total risk is not excessive. The duties of some group underwriters are similar to those of insurance salespeople, and include meeting with union or employer representatives to discuss the types of policies available to their groups.

Places of Employment

About 60,000 persons—most of them men—worked as insurance underwriters in 1972. Nearly three-fourths were property and liability underwriters working in field or home offices throughout the United States; most life insurance underwriters are in home offices in a few large cities, such as Hartford, New York City, Chicago, Dallas, and San Francisco.

Training, Other Qualifications, and Advancement

For beginning underwriting jobs, most insurance companies seek college graduates who have degrees in liberal arts or business administration, but a major in almost any field provides a good general background. Some high school graduates who begin as underwriting clerks may be trained as underwriters after they demonstrate an aptitude for the work.

College graduates usually start as trainees or junior underwriters. They study claim files to learn the factors associated with certain types of losses and carry out their work assignments under an experienced risk appraiser. Many supplement on-the-job training with courses and instruction at home office schools or local colleges and universities. Many firms pay tuition and the cost of books for those who satisfactorily complete underwriting courses. Some companies offer salary increases as an incentive. Several independent study programs are available through associations such as the American Institute for Property and Liability Underwriters, the American College for Life Underwriters, the Home Office Life Underwriters

Association and the Institute of Home Office Underwriters, and the Life Office Management Association.

Underwriting can be a satisfying career for a young man or woman who likes working with details and enjoys relating and evaluating facts. In addition to analyzing problems, underwriters must make prompt decisions and be able to communicate their ideas to others. They also must be imaginative and aggressive, especially when they have to get additional information from outside sources.

Experienced underwriters who complete study courses may advance to chief underwriter or underwriting manager. Some underwriting managers are promoted to senior managerial jobs after several years.

Employment Outlook

The employment of underwriters is expected to grow moderately through the mid-1980's as insurance sales continue to expand. Each year many jobs will become available as the occupation grows and as those who die, retire, or transfer to other work are replaced.

Several factors underlie the expected growth in the volume of insurance and the resulting need for underwriters. Higher personal incomes should stimulate purchases of life insurance, especially policies which provide retirement income and money for children's education. Property and liability insurance sales should expand as purchases of automobiles, pleasure boats, and other consumer durables increase. Both spending for new home construction and the American public's growing security consciousness should contribute to demand for more extensive insurance protection. Expanding businesses will need protection for new plants and equipment and insurance for workmen's compensation and product liability. Heightened competition among insurance companies and changes in regulations affecting investment profits also are expected to increase the insurance industry's need for competent underwriters.

Earnings and Working Conditions

College graduates hired as underwriter trainees averaged $8,140 a year in 1972, according to a Life Office Management Association (LOMA) survey of 55 U.S. companies. Senior underwriters (those with 5 years' experience) earned $10,000 to $15,000 in 1972; supervisors of underwriting in life insurance companies averaged $13,000 to $20,000. In most cases, underwriters in larger companies earned higher salaries. Salary ranges also were higher in the Eastern and Central states, slightly lower in the West, and substantially lower in the South.

An American Insurance Association/American Mutual Insurance Alliance survey of companies that sell property and liability insurance showed that experienced underwriters averaged $10,000 a year in 1972. Earnings varied by underwriting specialty; ocean marine underwriters earned the highest and personal line underwriters the lowest annual salaries. Experienced underwriters earn nearly twice the average earnings of nonsupervisory workers in private industry, except farming. Underwriting supervisors in property and liability companies averaged $13,400 a year in 1972; many earned over $16,000.

Most underwriters have desk jobs that require no unusual physical activity. Although the average week is 35 to 40 hours, underwriters sometimes work overtime. Most insurance companies have liberal vacation policies and other employee benefits. (See the statement on the Insurance Industry for additional information on working conditions and employee benefits.)

Sources of Additional Information

General information about a career as an insurance underwriter is available from the home offices of many life insurance and property and liability insurance companies. Information about career opportunities as an underwriter also may be obtained from:

Institute of Life Insurance, 277 Park Ave., New York, N.Y. 10017.

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

American Mutual Insurance Alliance, 20 North Wacker Dr., Chicago, Ill. 60606.

ADMINISTRATIVE AND RELATED OCCUPATIONS

Most administrative workers are professional office employees who run, or help run, business and other organizations. Some are managers, who supervise, plan operations, and make company policy. Others provide assistance to management, such as personnel workers who recruit and hire staff members and handle employee problems. The success or failure of an organization depends heavily on the way administrative workers do their jobs.

Nearly all administrative jobs require a college degree, although employers vary in the specific area of study they prefer. Some seek business administration or liberal arts graduates; others want a background in a technical area such as engineering or science.

Many administrative workers solve problems and make decisions using numbers and technical data. In addition, these workers must be tactful and able to get along with others. They must be able to handle the uneven flow of work in offices.

This section describes several administrative occupations including **city managers, Accountants, Credit Officials, and Personnel workers.**

ACCOUNTANTS

(D.O.T. 160.188)

Nature of the Work

Managers must have up-to-date financial information to make important decisions. Accountants prepare and analyze financial reports that furnish this kind of information.

Three major accounting fields are public, management, and government accounting. Public accountants are independent practitioners or employees of accounting firms. Management accountants, often called industrial or private accountants, handle the financial records of their firms. Government accountants examine the records of government agencies and audit private businesses and individuals whose dealings are subject to government regulations.

Accountants often specialize in areas such as auditing, taxes, or budgeting and control. Many public accountants specialize in auditing (reviewing a client's financial records and reports to judge their reliability). Others advise clients on tax matters and other financial and accounting problems. Management accountants provide the financial information that executives need to make intelligent business decisions. They may specialize in taxes, budgeting, investments, or internal auditing (examining and appraising their firms' financial systems and management control procedures). Many accountants in the Federal Government work as Internal Revenue agents, investigators, and bank examiners; other government accountants have regular accounting positions.

Places of Employment

More than 700,000 people worked as accountants in 1972; about 20 percent were Certified Public Accountants (CPA's). About 3 percent of the CPA's and 22 percent of all accountants are women.

More than 60 percent of all accountants do management accounting work. An additional 20 percent

Accountant discusses client's financial records.

are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. Other accountants work for Federal, State and local government agencies, and a small number teach in colleges and universities.

Accountants are found wherever business, industrial, or government organizations are located. Most, however, work in large urban areas where many public accounting firms and central offices of large businesses are concentrated.

Training, Other Qualifications, and Advancement

Training in accounting is available at colleges and universities, accounting and business schools, and correspondence schools. Although many graduates of business and correspondence schools are successful in small accounting firms, most large public accounting and business firms require applicants to have at least a bachelor's degree in accounting or a closely related field. Many employers prefer those with the master's degree in accounting. For beginning accounting positions, the Federal Government requires 4 years of college training (including 24 semester hours in accounting or related subjects) or an equivalent combination of education and experience. For teaching positions, most colleges and universities require the master's degree or the doctorate with the Certified Public Accountancy Certificate.

Previous work experience in accounting can help an applicant get a job. Many colleges offer students an opportunity to gain experience through internship programs conducted by public accounting or business firms.

Anyone working as a "certified public accountant" must hold a certificate issued by the State board of accountancy. All states use the CPA examination, administered by the American Institute of Certified Public Accountants, to establish certification. Although only half the States require CPA candidates to be college graduates, most successful candidates have college degrees. Nearly all States require applicants to have at least 2 years of public accounting experience for a CPA certificate.

Requirements vary, but more than half the States restrict the title "public accountant" to those who are licensed or registered. Information on requirements may be obtained directly from individual State boards of accountancy or from the National Society of Public Accountants.

People planning a career in accounting should have an aptitude for mathematics. Neatness and accuracy also are necessary. Employers seek applicants who handle responsibility and work with little supervision.

Accountants who want to get to the top in their profession usually must continue their study of accounting even though they already have college degrees or CPA certificates. They may take part in seminars sponsored by various professional associations or take courses offered by their employers. An increasing number of accountants study computer operation and programming to adapt accounting procedures to new data processing methods. Although capable accountants may advance rapidly, those having inadequate academic preparation are likely to be assigned routine jobs and may find promotions difficult to obtain.

Junior public accountants usually start by assisting with auditing work for several clients. They may advance to intermediate positions with more responsibility in 1 or 2 years and to senior positions within another few years. In larger firms, those who deal successfully with top industry executives often become supervisors, managers, or partners, or transfer to executive positions in private firms. Some open their own public accounting offices.

Beginning management accountants often start as ledger accountants, junior internal auditors, or as trainees for technical accounting positions. They may advance to jobs such as chief plant accountant, chief cost accountant, budget director, senior internal auditor, or manager of internal auditing. Some become controllers, treasurers, financial vice-presidents, or corporation presidents. In the Federal Government, beginners are hired as trainees and usually promoted in a year or so. In college and university teaching, those having minimum training and experience may receive the rank of instructor without tenure; advancement and permanent faculty status depend upon further education and teaching experience.

Employment Outlook

Employment of accountants is expected to increase rapidly through the mid-1980's as businesses and government agencies continue to expand in size and complexity. Thousands of additional openings will occur as employees die, retire, or leave their jobs to seek other work.

Greater use of accounting information in business management, changing tax systems, and growth of large corporations that must provide financial reports to stockholders, all point to excellent opportunities for accountants. Because of the growing complexity of business accounting requirements, accountants with college degrees will be in stronger demand than those who lack this training. In addition, the trend toward specialization will

create opportunities for people trained in a specific phase of accounting.

As data processing systems continue to replace manual preparation of accounting records and statements, the need for some lower level accountants may be reduced or eliminated. On the other hand, many highly-trained accountants will be required to prepare, administer, and analyze the information made available by these systems.

Earnings and Working Conditions

Starting salaries of beginning accountants in private industry were $9,100 a year in 1972, according to a Bureau of Labor Statistics survey in urban areas. Earnings of experienced accountants ranged between $11,900 and $17,400, depending on their level of responsibility and the complexity of the accounting system. In general, experienced accountants earn about twice as much as average earnings of all nonsupervisory workers in private industry, except farming. Chief accountants who direct the accounting program of a company or one of its establishments earned between $15,300 and $26,500, depending upon the scope of their authority and size of professional staff.

According to the same survey, beginning auditors averaged $9,600 a year, while experienced auditors' earnings ranged between $12,900 and $15,900.

Salaries generally are somewhat higher for accountants holding a graduate degree or a CPA certificate. Earnings also are higher for those who are required to travel a great deal.

In the Federal Civil Service the entrance salary for junior accountants and auditors was about $7,700 in early 1973. Candidates who had superior academic records received a starting salary of about $9,500. Some auditors began at about $10,300. Experienced accountants in the Federal Government averaged about $20,000 a year. Those with administrative responsibilities earned more.

Accountants often work very long hours under heavy pressure during the tax season and some travel extensively. The majority, however, remain in one office and work between 35 and 40 hours a week, under the same general conditions as fellow office workers.

Sources of Additional Information

Information about CPA's and aptitude tests given in many high schools, colleges, and public accounting firms may be obtained from:

American Institute of Certified Public Accountants, 666 Fifth Ave., New York, N.Y. 10019.

Further information on specialized fields of accounting is available from:

National Association of Accountants, 919 Third Ave., New York, N.Y. 10022.

National Society of Public Accountants, 1717 Pennsylvania Ave., NW., Washington, D.C. 20006.

ADVERTISING WORKERS

(D.O.T. 050.088, 132.088, 141.081 and .168, 162.158, and 164.068 through .168)

Nature of the Work

Through advertisements, businesses try to reach potential customers and persuade them to buy their products or services. Advertising workers are employed in many industries to plan and prepare ads. To get advertisements before the public, copywriters write texts; artists prepare illustrations; administrative and technical workers reproduce "ads"; and salesmen sell advertising space and time for publications, radio, and television. In some small advertising organizations, one person handles all these tasks; large organizations, however, may employ research, copywriting, and other specialists. The following specialties commonly are found in advertising work.

Advertising managers direct a firm's advertising program. They decide policy questions such as the type of advertising, the advertising budget, and the agency to employ. The advertising manager and agency work together to plan the program and carry it through. They also may supervise the preparation of special sales brochures, display cards, and other promotional materials. Advertising managers of newspapers, radio stations, or other advertising media are responsible for selling advertising time or space. Their work is similar to that of sales managers in other businesses.

Account executives work in advertising agencies to handle relations between the agency and its clients. An account executive studies the client's sales and advertising problems, develops a plan to meet the client's needs, and seeks his approval of the proposed program. Account executives must be able to sell ideas and maintain good relations with clients. They must also know how to write copy and use artwork, even though copywriters and artists usually carry out their ideas and suggestions. Some advertising agencies have account supervisors who oversee the work of the account executives. In others, account executives are responsible directly to agency heads.

Research directors and their assistants assemble and analyze information for advertising programs. They study possible uses of a product, its advantages and disadvantages compared to competing products, and ways of reaching potential buyers. These workers may survey buying habits and motives of customers, or try out sample advertisements to find the best selling theme or media. (See the statement on Marketing Research Workers for more information on this occupation.)

Advertising copywriters create the headlines, slogans, and text that attract buyers. They collect information about products and potential customers. Copywriters use a knowledge of psychology and writing to prepare copy especially suited for the particular readers or listeners sought as buyers and for the advertising medium used. They may specialize in a type of copy that appeals to certain groups—housewives, businessmen, scientists, engineers—or that deals with a class of items such as packaged goods or industrial products. In advertising agencies, copywriters work closely with account executives, although they may also be under the supervision of a copy chief.

Artists and layout workers plan and create visual effects in advertisements. (See the statements on Commercial Artists and Photographers elsewhere in the *Handbook* for more information on these occupations.)

Advertisers and advertising agencies employ *media directors* (or *space buyers* and *time buyers*) to negotiate contracts for advertising space or time. They determine where and when advertising should be carried to reach the largest group of prospective buyers at the least cost. They must know the advertising costs in different media and the characteristics of the audience reached in various parts of the country by specific publications, broadcasting stations, and other media.

Production managers and their assistants arrange to have the copy and art work converted into print. They deal with printing, engraving, filming, recording, and other firms involved in the reproduction of advertisements. The production manager needs a thorough knowledge of printing, photography, paper and inks, and related technical materials and processes.

Places of Employment

In 1972, about 150,000 people worked in jobs that require considerable knowledge of advertising. More than one-third were employed in advertising agencies, largely concentrated in New York City and Chicago.

These workers also are employed by organizations having products or services to sell, like manufacturing companies and stores; by advertising media, such as newspapers and magazines; and by firms providing services to advertisers, including printers, engravers, art studios, and product and package designers.

Training, Other Qualifications, and Advancement

Most employers prefer college graduates having liberal arts training or majors in advertising, marketing, journalism, or business administration. However, no typical educational background is equated with success in advertising. Experience in copywriting, work on school publications, or summer jobs with marketing research services are helpful.

Some large advertising organizations recruit outstanding college graduates and train them through programs that cover all aspects of advertising work. Some beginners start as assistants in research or production work or as space or time buyers. A few begin as junior copywriters.

Most advertising jobs require a flair for language, both spoken and written. Because every assignment requires specialized handling, an ability for problem-solving also is important. Advertising workers should be interested in people and things; they also need tact to help them sell their ideas to superiors, advertisers, and the public. They must also be able to accept criticism and work as part of a team.

Copywriters and account executives may advance to managerial jobs or more responsible work in their own specialties, if they demonstrate ability in dealing with clients. Some top-flight copywriters and account executives establish their own agencies.

Employment Outlook

Employment of advertising workers is expected to increase moderately through the mid-1980's, as the volume of consumer goods and

competition among manufacturers increase. Although opportunities should be favorable for highly qualified applicants, those seeking entry jobs will face stiff competition. Most openings will result from the need to replace those who retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

According to the limited information available, annual starting salaries for beginning advertising workers with bachelor's degrees ranged from $6,500 to $10,000 in 1972 and from $11,000 to $13,000 for those with master's degrees. The higher starting salaries usually were paid by very large firms to outstanding college graduates.

Salaries of experienced advertising workers employed by advertising agencies varied by size of firm and type of job. For example, account executives' salaries averaged $18,000 to $22,000 a year; media directors, $10,000 to $16,000, according to limited information.

Advertising workers frequently work under great pressure. Working hours sometimes are irregular because of deadlines and last minute changes. People in creative jobs often work evenings and weekends to finish important assignments.

Advertising may be a satisfying career for those who enjoy variety, excitement, creative challenges, and competition. Advertising workers experience the satisfaction of having their work in print, on television, or on radio, even though they remain unknown to the public at large.

Sources of Additional Information

Information on advertising agencies and the careers they offer may be obtained from:

American Association of Advertising Agencies, 200 Park Ave., New York, N.Y. 10017.

Association of Industrial Advertisers, 41 East 42nd Street, New York, N.Y. 10017.

A list of schools providing training in advertising may be obtained from:

American Advertising Federation, 1225 Connecticut Ave., NW., Washington, D.C. 20036.

CITY MANAGERS

(D.O.T. 188.118)

Nature of the Work

Population growth and industrial expansion place increasing pressure on housing, transportation, and other facilities of cities. Problems associated with growing modern communities, such as air and water pollution and rising crime rates, also demand attention. To cope effectively with these problems, sophisticated management techniques are required. Consequently, many communities hire a specialist who has these skills—the city manager.

A city manager is responsible to the community's elected officials who appoint him. Although duties vary by city size, city managers generally coordinate and administer activities of operating departments, such as tax collection and disbursement, law enforcement, and public works; hire department heads and their staffs; and prepare the annual budget to be approved by elected officials. They also study current problems, such as unionization of government employees or urban renewal, and report their findings to the elected council.

City managers must plan for future growth and development of cities and surrounding areas. To provide for an expansion of public ser-

City manager discusses urban renewal project with staff.

vices, they frequently appear at civic meetings to advocate certain programs or to inform citizens of current government operations.

City managers work closely with planning departments to coordinate new and existing programs. In smaller cities that have no permanent planning staff, coordination may be assumed entirely by the manager.

Many cities employ assistant city managers, department head assistants, and administrative assistants to aid city managers. Under his direction, they administer programs, prepare reports, receive visitors, answer correspondence, and generally help to keep the city functioning smoothly. Assistant city managers organize and coordinate city programs, supervise city employees, and act for the city manager when he is absent. They also may assume responsibility for some projects, such as the development of a preliminary annual budget. Department head assistants generally are responsible for one activity, such as personnel, finance, or law, but also may assist in other areas. Administrative assistants, also called executive assistants or assistants to the city manager, usually do administrative and staff work in all departments under the city manager. For instance, they may compile operating statistics, or review and analyze work procedures.

Places of Employment

About 2,500 city managers, nearly all of them men, were employed in 1972. In addition, several thousand persons worked as administrative assistants, department head assistants, and assistant city managers. About nine out of ten city managers worked for cities and counties having a council-manager form of government. Most of the remainder worked in municipalities having other forms of government, such as mayor-council government in which the mayor appoints the city manager as his "administrative assistant" or "chief administrative officer." A few city managers also worked for metropolitan or regional planning organizations and councils of governments.

Although four-fifths of all city managers work for small cities with populations less than 25,000, most larger cities also employ a city manager. About half of the cities with populations between 10,000 and 500,000 have city managers. City managers work in all States except Hawaii and Indiana, but one-half are concentrated in Eastern United States.

Training, Other Qualifications, and Advancement

A bachelor's degree, preferably with a major in political science or public administration, is the minimum educational background needed to become a city manager. However, a master's degree in public or municipal administration is preferred.

In 1972, about 90 colleges and universities offered graduate degree programs in public or municipal administration. Degree requirements in some schools include successful completion of an internship program in a city manager's office. During this internship period, which may last from 6 months to a year, the degree candidate observes local government operations and does research under the direct supervision of the city manager.

Most new graduates work as administrative assistants to city managers for several years and gain experience in solving urban problems, coordinating public services, and management techniques. Others work in an area of government operations such as finance, public works, or public planning. They may acquire supervisory skills and additional experience by working as assistant city manager or department head assistant in operations. City managers first are employed in small cities, but during their careers, they usually work in several cities of increasing size to gain experience.

Young persons who plan a career in city management should like to work with detail and as part of a team. They must have sound judgment, self-confidence, and be able to perform well under stress. To handle emergency situations, city managers must quickly isolate problems, identify their causes, and provide alternate solutions. City managers should be tactful and able to communicate with and work well with people.

City managers also must be dedicated to public service since they often put in long hard hours in times of crises.

Employment Outlook

This small occupation is expected to grow very rapidly as problems of our growing cities become complex. Examples of this complexity are computerized data collection of police information, advances in technology of traffic control, and the application of systems analysis to urban problems. The demand for city managers also will increase as cities convert to the council-manager form of government, currently the fastest growing form of city government. Furthermore, city managers will be needed in places having other forms of government to help elected officials cope with day-to-day operations of government.

Persons who seek beginning city management jobs as administrative assistants, department head assistants, or assistant city managers may

face competition through the mid-1980's, especially if they do not have a graduate degree in public administration or related management experience. Competition should be keen among the growing number of administrative assistants, department head assistants, and assistant city managers for the relatively few city manager positions.

Earnings and Working Conditions

Salaries of city managers and their assistants vary according to their education and experience as well as job responsibility and size of city. Generally, city manager's earnings are very high relative to the average earnings for nonsupervisory workers in private industry, except farming. In 1972, annual salaries of city managers ranged from about $12,000 in cities of 5,000 to more than $35,000 in cities of more than 250,000, according to the International City Management Association. In cities of 10,000 or more, seven out of ten city managers were paid at least $20,000. City managers in cities not having council-manager governments received slightly less.

Salaries of assistant city managers and department head assistants ranged from about $10,000 in small cities to more than $25,000 in large ones. They were generally paid about three-fourths the salaries paid city managers. Administrative assistant salaries typically ranged from $8,500 to $10,000, annually.

City managers often work more than 40 hours a week. Emergency problems may require evening and weekend work and meetings with individuals and citizen's groups consume additional time.

Fringe benefits usually include health and life insurance programs, pension plans, sick leave, vacation time, and often a car for official business. Managers generally are reimbursed for expenses incurred while attending professional meetings and seminars.

Sources of Additional Information

International City Management Association, 1140 Connecticut Ave. NW., Washington, D.C. 20036.

COLLEGE STUDENT PERSONNEL WORKERS

(D.O.T. 045.108, 090.118, 090.168, 129.108 and 166.168)

Nature of the Work

A student's choice of a particular institution of higher education for further study is influenced by many factors. Availability of a specific educational program, quality of the school, and cost, as well as proximity to home, may all play important roles.

For many students, an equally important standard is the institution's ability to provide for their housing, social, cultural, and recreational needs. Development and administration of the latter services, and of similar programs serving students' well-being in addition to their educational needs, provide a wide variety of jobs for college student personnel workers. The admissions officer, registrar, the dean of students, and the career planning and placement counselor are probably the best known among these. Some other types of workers that may make up this broad occupational field are student activities and college union personnel, student housing officers, counselors in the college counseling center, financial aid officers and foreign student advisors.

Titles of student personnel workers vary from institution to in-

stitution and from program to program within a single school. Titles also vary with the level of responsibility within a certain student personnel program. The more common titles include dean, director, officer, associate dean, assistant director, and counselor.

The *dean of students*, or the vice president for student affairs, heads the student personnel program at a school. Among his duties, he evaluates the changing needs of the students and helps the president of the college develop institutional policies. The dean of students generally coordinates a staff of associate or assistant deans; these are in charge of the specific programs that deal directly with the students.

At some schools, the admissions office and the records office are separate. *Admissions Counselors* interview and evaluate prospective students and process their applications. They may travel extensively to recruit high school, junior college and older students and to acquaint them with opportunities available at their College. They work closely with faculty, administrators, financial aid personnel and public relations staff to determine policies for recruiting and admitting students. Personnel in the office of the *registrar* maintain the academic records of students, and provide current enrollment statistics for communication both within the college and between the college and the community.

Student financial aid personnel assist students in obtaining financial support to pay for their education. Workers in this field must keep well informed about sources of financial aid, funding, and about management of all forms of financial aid—scholarships, grants, loans, student employment, fellowships, teaching and research assistantships. They work closely with administrators, the admissions, counseling, business, and academic office staffs.

Career planning and placement counselors, sometimes called college placement officers, assist students in making long-range career selections and may also help students get part-time and summer jobs. On many campuses, they arrange for prospective employers to visit the school to discuss their firm's personnel needs and to interview applicants. (For further information on this field, see statement on College Career Planning and Placement Counselors).

The student personnel staff in charge of *student activities* work with members of proposed and established student organizations, especially with student government. They help the student groups to plan, implement, and evaluate their activities. Often, the student activities staff will assist in the orientation of new students.

College union staff members work with students to provide intellectual, cultural, and recreational programs. Many college union staff members are responsible for directing the operation of the physical facilities and services of the building, such as food and recreational services, building maintenance, fiscal planning, conference facilities, and employee supervision.

Student housing officers sometimes live in the dormitories and, in general, help the students to live together in harmony. They may serve as counselors to individual students with personal problems. Housing officers also may be involved in managing the fiscal, food service, and housekeeping operation of student residences.

Counselors help students with personal, educational, and vocational problems. Students may come to the counselors on their own or be referred by a faculty member, a residence hall counselor, or a friend. Topics of discussions may include lack of self-confidence or motivation on the part of the student, failure in academic work, desire to leave college or transfer to another college, inability to get along with others, loneliness, drug abuse, or marriage problems. In addition, there is a growing trend for counselors to try to reach more students by establishing group sensitivity sessions and telephone "hotlines". Counselors often administer tests that indicate aptitudes and interests to students having trouble understanding themselves. Some also teach in the college or assist with admissions, orientation and training of residence hall staff. (For further information on this field, see statement on Psychologists.)

Foreign student advisers administer and coordinate many of the services which are crucial in insuring a successful academic and social experience for students from other countries. They usually assist with foreign student admissions, orientation, financial aid, housing, English as a foreign language, academic and personal advising, student-community relationships, placement, and alumni relations. In addition they may be an adviser for international associations and nationality groups and for United States students interested in study, educational travel, work, or service projects abroad.

Places of Employment

An estimated 35,000 to 40,000 college student personnel workers, roughly one-third of them women, were employed in 1972. Every college and university, whether a two-year or a four-year school, has a staff performing student personnel functions. They are not always organized as a unified program. Large colleges and universities generally

have specialized staffs for each personnel function. However, in many small colleges the entire student personnel program may be carried out by just a few persons.

Training, Other Qualifications, and Advancement

Because of the diversity in duties, the education and backgrounds of college student personnel workers vary considerably. A bachelor's degree is the minimum requirement; however, for some student personnel programs it is necessary to have a master's degree, and others in the field have doctoral degrees.

In 1972, more than 100 colleges and universities offered graduate programs in student personnel work. However, many employers prefer instead a graduate degree in a specific academic field added to some courses in student personnel work. A master's degree in clinical or counseling psychology is usually required for work as a college counselor. This degree also is helpful in other student personnel fields such as career planning and placement. Business administration also is helpful, especially for those who wish to go into the admissions, records, college union, financial aid, or student housing fields. Familiarity with data processing is an asset especially for work in admissions, records, or financial aid. Social science and recreation degrees also are useful, as is work experience in business, government, or educational associations. The majority, however, have degrees in education or the social sciences.

College student personnel workers must be interested in, and able to work with, people of all backgrounds and ages. They must have the patience to cope with conflicting viewpoints of students, faculty, and parents. People in this field often deal with the unexpected and the unusual, therefore emotional stability and the ability to function while under pressure are necessities.

Entry-level positions are usually those of student activities advisors, admissions counselors, financial aid counselors, residence hall directors, and assistants to deans. Persons without graduate degrees may find advancement opportunities limited. A doctorate is usually necessary for the top student personnel positions.

Employment Outlook

Employment of college student personnel workers is likely to remain relatively stable through the mid-1970's. Tightening budgets, in both public and private colleges and universities, is the chief factor underlying this expected stability in employment. Student personnel positions least likely to be affected if some reduction in number becomes necessary are those most closely tied to the academic function of the school—admissions, financial aid, records, and counseling. The number of graduate programs in student personnel is continuing to grow as is the number of graduates, a situation which the National Association of Student Personnel Administrators feels could result in competition for jobs in this field. Over the short run, until colleges and universities resolve their financial difficulties, most openings each year will result from the need to replace personnel who transfer to other positions, retire, or leave the field for other reasons.

After the mid-1970's, however, employment of student personnel workers is expected to increase as colleges provide more services for students, especially the growing number from low-income and minority families who often require special counseling and assistance. The increasing number of college students, particularly in junior and community colleges, is a factor which also could contribute to some growth in the student personnel occupations, especially if financial problems should ease. Two-year public colleges, for the most part, have less serious financial problems because, unlike most four-year colleges, their enrollments are growing and their operating costs are moderate.

Earnings and Working Conditions

Median salaries of *chief student affairs officers* ranged from $11,900 in small non-public colleges to $26,000 in large public universities in 1972, according to a National Education Association survey of public and private colleges and universities. Median salaries of *deans of admissions* ranged from $11,062 to $19,400; for *registrars*, from $8,130 to $17,725. *Directors of student testing and counseling* had median salaries of $9,900 to $19,800. The median salaries of the other student personnel workers were somewhat lower.

College student personnel workers frequently work more than a 40-hour week; often irregular hours and overtime work are necessary. Employment in these occupations is usually on a 12-month basis. In many schools, they are entitled to retirement, group medical and life insurance, sabbatical and other benefits.

Sources of Additional Information

A pamphlet, *Careers in Higher Education*, is available from:

The American Personnel and Guidance Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

CREDIT OFFICIALS

(D.O.T. 168.168 and 186.288)

Nature of the Work

Many daily activities of businesses and individuals depend upon receiving goods and services on credit or obtaining cash loans. In most forms of credit granting, a credit official makes the decision to accept or reject the application. These workers include *credit managers*, who authorize customer purchases when payment is promised at a later date, and *loan officers*, who approve cash loans by financial institutions.

In extending credit to a business (commercial credit), the credit official analyzes detailed financial reports submitted by the applicant, interviews a company representative about its management, and reviews credit agency reports to determine the firm's reputation for repaying debts. He also checks at banks where the company has deposits or previously was granted credit. In extending credit to individuals (consumer credit), detailed financial reports usually are not available. The credit official must rely more on personal interviews, credit bureaus, and banks to provide information about the person applying for credit.

Loan officers in many large banks make decisions based on their analysis of reports submitted by credit analysts. Officers may specialize in handling certain types of credit, such as installment loans, commercial loans, real estate mortgages, and agricultural loans. In smaller financial institutions, such as branch banks and consumer finance companies, the loan officer (who sometimes is the manager of the firm) may do all the work of granting loans himself. He may interview applicants, analyze the information gained in the interview, and make the final lending decision.

Credit manager reviews previous credit transactions from computer printout.

Credit managers in retail and wholesale trade usually cooperate with the sales department in developing credit policies liberal enough to allow the company's sales to increase and yet strict enough to deny credit to customers whose ability to pay their debts is questionable.

A credit manager frequently must contact a customer who is unable or refuses to repay his debt. He does this though writing, telephoning, or personal contact. If these attempts at collection fail, the credit manager may refer the account to a collection agency or assign an attorney to take legal action. Some credit managers supervise workers who gather information, analyze facts, and perform general office duties in a credit department; they include *investigation clerks, application clerks, credit authorizers, information clerks, credit collectors, adjustment clerks, bookkeepers,* and *secretaries.*

Places of Employment

More than 110,000 credit officials were employed in 1972; most were men. About 75,000 were credit managers working in wholesale and retail stores, in manufacturing firms, and for services that process a company's credit operations. Loan officers working in banks and other financial institutions numbered about 40,000. In addition, some other bank officers, general managers, and office managers spend part of their time supervising the granting of credit within their companies.

Although goods and services are sold on credit, and cash loans granted, throughout the United States, most credit officials work in urban areas where many financial and business establishments are located.

Training, Other Qualifications, and Advancement

A college degree is becoming increasingly important for entry level jobs as credit officials. Employers usually seek persons who have majored in business administration,

economics, or accounting, but may instead hire graduates holding liberal arts degrees. Some employers promote high school graduates to credit official positions if they have experience in credit collection or processing credit information.

The new credit official may be hired as a management trainee and work under the guidance of more experienced personnel in the credit department. Here he gains a thorough understanding of the company's credit procedures and policies and learns various sources of credit information. He may analyze previous credit transactions to learn how to recognize which applicants should prove to be good customers. The trainee also learns to deal with credit bureaus, banks, and other businesses that can provide information on the past credit dealings of their customers.

Many formal training programs are available through the educational branches of the associations that serve the credit and finance field. This training includes home study, college and university programs, and special instruction to improve beginners' skills and keep experienced credit officials aware of new developments in their field. Many banks will pay tuition for loan officers who take courses in credit and finance at colleges and universities.

A person interested in a career as a credit official should be able to analyze detailed information and draw valid conclusions based on this analysis. Because it is necessary to maintain good customer relationships, a pleasant personality and the ability to speak and write effectively also are characteristics of the successful credit official.

The work performed by credit officials allows them to become familiar with almost every phase of their respective businesses. Highly qualified and experienced officials can advance to top-level executive positions. However, in small and medium-sized companies, such opportunities are limited.

Employment Outlook

Employment of credit officials is expected to increase rapidly through the mid-1980's as the number of individual credit transactions continues to grow. In addition to opportunities resulting from growth, many jobs will open each year from the need to replace those who leave the occupation.

Although the increasing use of computers for storing and retrieving information will allow individual credit officials to serve more customers, this should not slow the growth of the occupation. As companies handle greater numbers of credit transactions, the credit official will spend more time managing and supervising the credit handling process in his firm. Moreover, many duties of credit officials, such as customer counseling and interviewing applicants, demand the tact and good judgment only personal contact can provide.

In addition, attractive credit terms are a major tool for increasing the sales volume of almost any business. As firms strive to maximize their sales, in the face of competition, there will be a greater demand for skilled credit officials who can establish credit policies strict enough to minimize bad debt losses.

Earnings and Working Conditions

In 1972, beginning credit officials earned annual salaries that ranged from about $7,500 to just over $10,000, depending on the type of credit granting performed and the geographic location of the job. Bank officers hired as trainees earned annual starting salaries of about $8,500. The Nation's largest banks and major business firms, however, may offer slightly higher salaries to entry level credit officials.

As credit officials gain experience and reach middle management positions, their earnings usually range from $10,000 to $20,000 a year; with the largest employers, earnings may be as high as $25,000 or more. Some individuals in top-level positions earned salaries well over $40,000 a year.

According to a Bank Administration Institute survey conducted in May of 1971, salaries of loan officers were generally highest in the Northeast and Middle Atlantic regions and lower in the South.

Credit officials normally work the standard workweek of their company—35-40 hours. Some work longer hours, particularly in retail trade where a seasonal increase in credit sales can produce a greater work volume.

Sources of Additional Information

General information about the field of consumer credit, including career opportunities, is available from:

The National Consumer Finance Association, 1000 16th St. NW., Washington, D.C. 20036.

Specific information about training programs available in consumer credit may be obtained from:

Society of Certified Consumer Credit Executives, 7405 University Dr., St. Louis, Mo. 63130.

For information about training programs available in commercial credit write:

Credit Research Foundation, 3000 Marcus Ave., Lake Success, N.Y. 11040.

HOTEL MANAGERS AND ASSISTANTS

(D.O.T. 163.118 and 187.118 and .168)

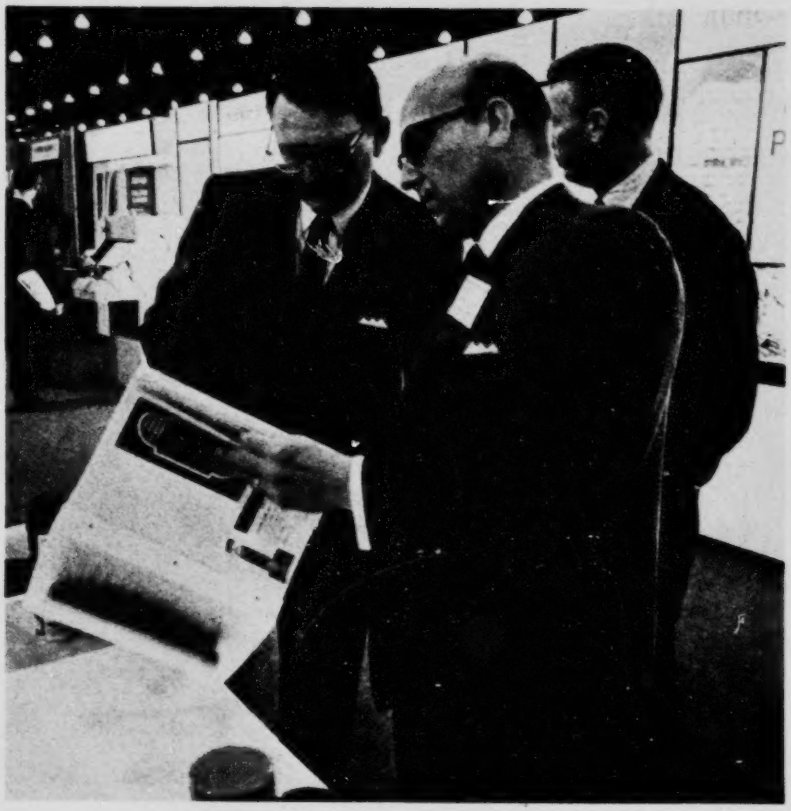
Nature of the Work

Hotel managers are responsible for profitably operating their establishments and providing maximum comfort for their guests. More than 110,000 managers worked in hotels and motels in 1972; 40,000 of these were self-employed. Managers direct and coordinate the activities of the front office, kitchen, and dining rooms; and various hotel departments including housekeeping, accounting, personnel, and maintenance. They determine room rates, establish credit policy, and have final responsibility for solving the many problems that arise in operating their hotels. Like other business managers, they may confer with business and social groups and participate in community affairs.

In small hotels, the manager also may do much of the front office clerical work. In the smallest hotels and in many motels, the owners—sometimes a family team—completely run the business.

The general manager of a large hotel may have several assistants who manage departments and assume general administrative responsibilities when he is absent. Because preparing and serving food is important in the operation of most large hotels, a special manager usually is in charge of this department. Managers of large hotels usually employ a sales manager to advertise hotel facilities for meetings, banquets, and conventions.

Since large hotel chains often centralize activities such as purchasing and planning employee training programs, managers in these hotels may have a smaller range of duties than those in independently owned establishments. Hotel chains may assign managers to organize either a newly acquired hotel, or to establish hotels in different cities or in foreign countries.



Hotel manager makes final arrangements for a convention.

Training, Other Qualifications, and Advancement

Although experience is generally the most important consideration in selecting managers, employers are increasingly emphasizing college education. Many believe a 4-year college curriculum in hotel and restaurant administration is the best educational preparation. Courses in hotel work, available in a few junior colleges and through the American Hotel and Motel Association, also are helpful.

College level courses in hotel management include hotel administration, accounting, economics, food service management and catering, and hotel maintenance engineering. Students are encouraged to work in hotels or restaurants during summer vacations. The experience gained and the contacts made with employers may help them to get better hotel jobs after graduation.

Managers should have initiative, self-discipline, and the ability to organize work and run a department or hotel. They must be able to concentrate on details and solve problems.

Some large hotels have special on-the-job management trainee programs in which trainees rotate among various departments. Outstanding employees may receive financial assistance for college study.

Most hotels promote employees with proven ability, usually front office clerks, to assistant manager and eventually to general manager. Hotel chains may offer better opportunities for advancement than independent hotels, since vacancies may arise anywhere in the chain or central office.

Employment Outlook

Hotel manager employment is expected to increase very rapidly through the mid-1980's. New positions will arise as additional hotels and motels are built. Many openings for management personnel also will occur as workers die, retire, or transfer to other jobs. Applicants having college degrees in hotel administration will have an advantage in seeking entry positions and later advancement.

See the Hotel statement elsewhere in the *Handbook* for information on Earnings and Working Conditions, Sources of Additional Information, and additional information on Employment Outlook.

INDUSTRIAL TRAFFIC MANAGERS

(D.O.T. 184.168)

Nature of the Work

Industrial firms want to receive raw materials and deliver customers' goods promptly, safely, and with minimum cost. Arranging the transportation of materials and finished products is the job of an industrial traffic manager. Industrial traffic managers analyze various transportation possibilities and choose the most efficient type for their companies' needs—rail, air, road, water, pipeline, or some combination. Then they select the route and the particular carrier. To make their decisions, managers consider factors such as freight classifications and regulations, time schedules, size of shipments, and loss and damage rates. (This statement does not cover traffic managers who sell transportation services for railroads, airlines, trucking firms, and other freight carriers.)

Activities of industrial traffic managers range from checking freight bills to deciding whether the company should buy its own fleet of trucks rather than contract for services. They route and trace shipments, arrange with carriers for transportation services, prepare bills of lading and other shipping documents, and handle claims for lost or damaged goods. Traffic managers keep records of shipments, freight rates, commodity classifications, and applicable government regulations. They also must stay informed about changing transportation technology, such as containerization (the use of containers packed with many individual items). Some traffic managers (called physical distribution managers) are responsible for packaging shipments and maintaining warehouse facilities and transportation equipment.

Traffic managers often consult with other company officials about the firm's transportation needs. They may, for example, work with production department personnel to plan shipping schedules, or with members of the purchasing department to determine what quantities of goods can be transported most economically.

Since many aspects of transportation are subject to Federal, State, and local government regulations, traffic managers must know about these and any other legal matters that apply to their companies' shipping operations. High level traffic managers represent their companies before ratemaking and regulatory bodies such as the Interstate Commerce Commission, State commissions, and local traffic bureaus.

Places of Employment

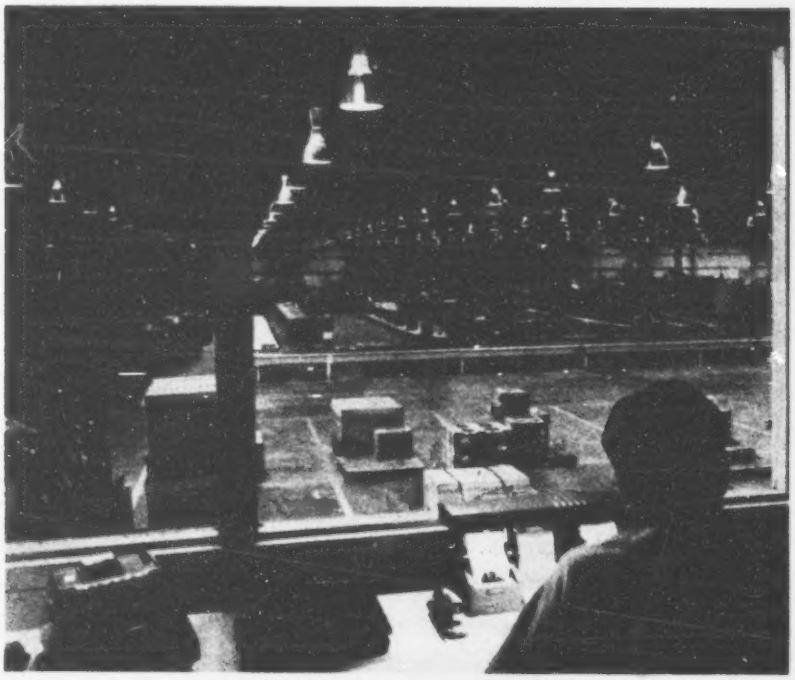
More than 20,000 persons were industrial traffic managers in 1972. Although most jobs are found in manufacturing firms, some traffic managers work for large stores. A few are self-employed consultants, or work for firms that handle transportation problems for clients. Most traffic managers are men.

Training, Other Qualifications, and Advancement

Although high school graduates with experience in traffic departments sometimes are hired as traffic managers, a college education is becoming increasingly important in this field. For some kinds of work, college training is required. For example, in order to argue cases before the Interstate Commerce Commission, a traffic manager must meet standards that include at least 2 years of college. Although some employers prefer graduates who have a degree in traffic management, others seek liberal arts majors who have had courses in transportation, management, economics, statistics, marketing, or commercial law.

Industrial traffic training is available through colleges and universities, traffic management schools, and seminars sponsored by private organizations. More than 100 colleges, universities, and junior colleges offer a degree in traffic management.

Industrial traffic managers should be able to analyze numerical and technical data such as freight rates and classifications to solve transportation problems. These jobs also require the ability to work independ-



Industrial traffic manager checking freight bills.

ently and to present facts and figures in a convincing manner.

Newly hired traffic managers often complete shipping forms and calculate freight charges. After gaining experience, they do more technical work such as analyzing transportation statistics. A competent worker may advance to a supervisory job such as supervisor of rates and routes; a few are promoted to assistant general traffic managers and eventually to general traffic managers. Industrial traffic managers can sometimes help their chances for advancement by participating in company-sponsored training programs or taking other courses in traffic management.

Employment Outlook

Employment of industrial traffic managers is expected to increase slowly through the mid-1980's as more businesses centralize their shipping and receiving activities in separate departments. A few openings will become available each year as new jobs are created, and as traffic managers die, retire, or leave the field for other reasons.

Growth in this occupation will stem from an increasing emphasis on efficient management of traffic activities and from the trends toward procuring materials over greater distances and distributing products in wider markets. There will be a strong demand for specialists who can obtain the lowest possible freight rates.

Earnings and Working Conditions

Industrial traffic managers, salaries started at about $9,000 a year in 1972, according to the limited information available. Although the earnings of experienced traffic managers vary by the company's transportation costs, they are much higher than the average for all nonsupervisory workers in private industry, except farming. Industrial traffic managers working for companies whose transportation requirements were small earned about $16,000 a year. Those in companies whose transportation needs were large received from $25,000 to $30,000 a year. Some traffic executives earned $40,000 or more a year.

Although industrial traffic managers usually have a standard work week, those in particularly responsible jobs may have to spend some time outside regular working hours preparing reports, attending meetings, and traveling to hearings before State and Federal regulatory agencies.

Sources of Additional Information

Information on education and technical training is available from:

American Society of Traffic and Transportation, Inc., 547 West Jackson Boulevard, Chicago, Ill. 60606.

LAWYERS

(D.O.T. 110.108, .118, and 119.168)

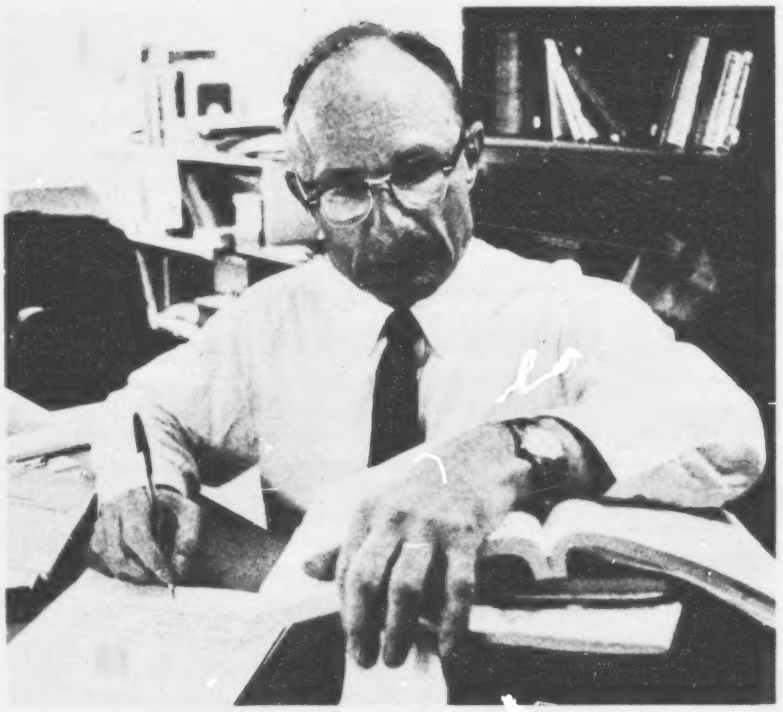
Nature of the Work

At some time in our life, each of us may need a lawyer for advice about our rights and responsibilities when buying property, making a will, or settling an estate. In addition, lawyers, also called attorneys, negotiate the settlement of legal problems out of court or, when necessary, represent clients in court or before government agencies.

Most lawyers are engaged in general practice, handling all kinds of legal work for clients. However, a significant number specialize in one

branch of law, such as corporation, criminal, labor, patent, real estate, tax, or international law. Some attorneys devote themselves entirely to trying cases in the courts. Others never appear in court but instead draw up wills, trusts, contracts, mortgages, and other legal documents; conduct out-of-court negotiations; and do investigative and other legal work to prepare for trials. Some may act as trustees by managing a person's property and funds or as executors by seeing that the provisions of their client's will are carried out. Still others teach, do research or writing, or perform administrative work. Government attorneys play a large part in developing Federal and State laws and programs; they prepare drafts of proposed legislation, establish law enforcement procedures, and argue cases.

Many people who have legal training do not work as lawyers but use their knowledge of law in other occupations. They may, for example, be insurance adjusters, tax collectors, probation officers, credit investigators, or claim examiners. A legal background also is an asset to those seeking or holding public office.



Legal research demands careful attention to detail.

Places of Employment

About 300,000 persons, most of them men, worked as lawyers in 1972. Most were in private practice, either self-employed (alone or in partnerships) or working for other lawyers or law firms.

In 1972, almost 15,000 lawyers worked for the Federal Government, chiefly in the Justice, Defense, and Treasury Departments, and the Veterans Administration; another 15,000 were employed by State and local governments. Others worked for private companies or taught in law schools. Some salaried lawyers also have independent practices; others do legal work part time while in another occupation.

Training, Other Qualifications, and Advancement

In order to practice law in the courts of any State, a person must be admitted to its bar. Applicants for admission to the bar must pass a written examination; however, a few States drop this requirement for graduates of their own law schools. A lawyer who has been admitted to the bar in one State usually can be admitted in another without taking an examination provided he meets that State's standards of good moral character and has a specified period of legal experience. Each Federal court or agency sets its own qualifications for those practicing before it.

To qualify for the bar examination in most States, an applicant must have completed 3 years of college and have graduated from a law school approved by the American Bar Association or the proper State authorities. A few States accept the study of law wholly in a law office or in combination with study in a law school; only California accepts study of law by correspondence as qualification for taking the bar exam. Several States require registration and approval of students by the State Board of Examiners, either before they enter law school, or during the early years of legal study. In a few States, candidates must complete clerkships before they are admitted to the bar.

The required college and law school work usually takes 7 years of full-time study after high school—4 years of college followed by 3 years in law school. Although a number of law schools accept students after 3 years of college, and a few after 2, an increasing number require appli-

cants to have a bachelor's degree. To meet the needs of students who can attend only part time, a number of law schools have night divisions which usually require 4 years of study. In 1971, about one-fourth of all law students in ABA-approved schools were enrolled in evening classes.

Law schools seldom specify college subjects that must be included in students' prelegal education. However, English, history, economics and other social sciences, logic, and public speaking are important for prospective lawyers. Students interested in a particular aspect of the law may find it helpful to take related courses; for example, engineering and science courses for the prospective patent attorney, and accounting for the future tax lawyer. Acceptance by most law schools depends on the applicant's ability to demonstrate an aptitude for the study of law, usually through the "Law School Admissions Test." In 1972, 149 law schools were approved by the American Bar Association. Others—chiefly night schools—were approved by State authorities only.

The first 2 years of law school generally are devoted to fundamental courses such as contracts, property law, and judicial procedure. In the third year, students may elect specialized courses in fields such as tax, labor, or corporation law. Practical experience is often acquired by participation in school-sponsored legal aid activities, in the school's practice court where students conduct trials under the supervision of experienced lawyers, and through writing on legal issues for the school's law journal. Graduates receive the degree of *juris doctor* (J.D.) from most schools, although some confer the *bachelor of laws* (L.L.B.) as the first professional degree. Advanced study is often desirable for those planning to specialize, do research, or teach in law schools.

The practice of law involves a great deal of responsibility. Young people planning careers in law should like to work with people and ideas, and be able to win the confidence of their clients.

Most beginning lawyers start in salaried positions, although some go into independent practice immediately after passing the bar examination. Newly hired salaried attorneys usually act as research assistants (law clerks) to experienced lawyers or judges. After several years of progressively responsible salaried employment, many lawyers go into practice for themselves. Some lawyers, after years of practice, become judges.

Employment Outlook

A rapid increase in the number of law school graduates seeking employment is expected to create keen competition for the available jobs. Graduates of well known law schools and those who rank high in their classes should find salaried positions with law firms, on the legal staffs of corporations and government agencies, and as law clerks for judges. Graduates of less prominent schools and those with lower scholastic ratings may experience some difficulty in finding salaried jobs. However, many will find opportunities in fields where legal training is an asset but not normally a requirement.

The employment of lawyers is expected to grow moderately through the mid-1980's as increased business activity and population create a demand for attorneys to deal with a growing number of legal questions. Supreme Court decisions extending the right to counsel for persons accused of lesser crimes, the growth of legal action in the areas of consumer protection, the environment, safety, and an expected increase in the use of legal services by middle income groups through prepaid legal service programs also should provide employment opportunities. Other jobs will be created by the need to replace lawyers who retire or leave the occupation for other reasons.

Prospects for establishing a new practice probably will continue to be best in small towns and expanding suburban areas. In such communities competition is likely to be less than in big cities and new lawyers may find it easier to become known to potential clients; also, rent and other business costs are somewhat lower. Salaried positions, on the other hand, will be limited largely to urban areas where the chief employers of legal talent—government agencies, law firms, and big corporations—are concentrated.

Earnings and Working Conditions

Lawyers entering practice in 1972 earned starting salaries ranging from $7,000 to $20,000 a year. Factors affecting the salaries offered to new graduates include: their academic records; and types, sizes, and locations of their employers; and whether the new lawyer has any specialized educational background that the employer requires. Lawyers with 1 year's experience working for manufacturing and business firms earned about $14,000 a year; those with a few years of experience earned $18,000 annually. In the Federal Government, annual starting salaries for attorneys were $11,614 or $13,996 in early 1973 depending upon their academic and personal qualifications. Those with a few years of experience earned $19,700 a year. On the average, lawyers earn over three times as much as nonsupervisory workers in private industry, except farming.

Beginning lawyers engaged in legal aid work usually receive the lowest starting salaries. New lawyers starting their own practices may earn little more than expenses during the first few years and may need to work part time in other occupations.

Lawyers on salary receive increases as they assume greater responsibility. In 1972, those in charge of legal staffs in private industry averaged more than $33,700 a year. Incomes of lawyers in private practice usually grow as their practices develop. Private practitioners who are partners in law firms generally earn more than those who practice alone.

Lawyers often work long hours and are under considerable pressure when a case is being tried. In addition, they must keep abreast of the latest laws and court decisions. However, since lawyers in private practice can determine their own hours and workload, many stay in practice well past the usual retirement age.

Sources of Additional Information

The specific requirements for admission to the bar in a particular State may be obtained at the State capital from the clerk of the Supreme Court or the secretary of the Board of Bar Examiners.

Information on law as a career is available from:

Information Service, The American Bar Association 1155 East 60th St., Chicago, Ill. 60637.

Information on specific topics such as developments in financial aid and law school accreditation is available from:

Association of American Law Schools, Suite 370, 1 Dupont Circle NW, Washington, D.C. 20036.

MARKETING RESEARCH WORKERS

(D.O.T. 050.088)

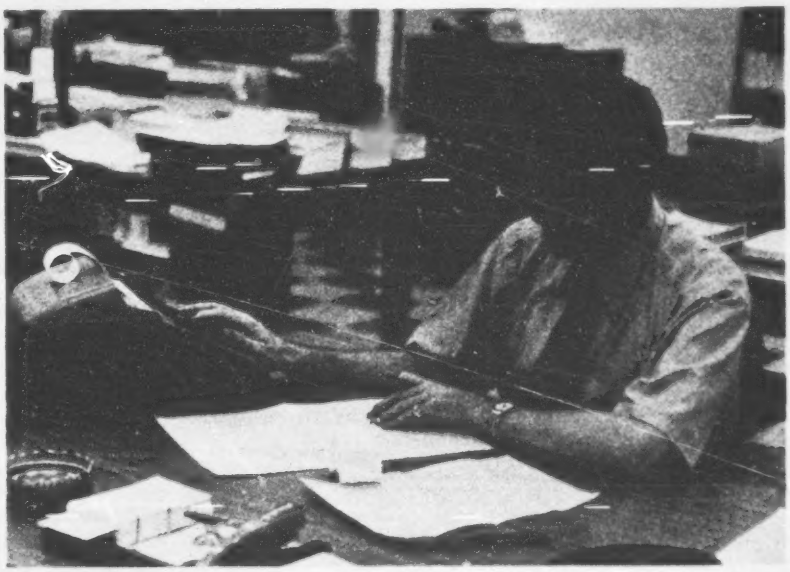
Nature of the Work

Businessmen require a great deal of information to make sound decisions on how to market their products. Marketing research workers provide much of this information by analyzing available data on products and sales, making surveys, and conducting interviews. They prepare sales forecasts and make recommendations on product design and advertising.

Most marketing research starts with the collection of facts from sources such as company records, published materials, and experts on the subject under investigation. For example, marketing research workers making sales forecasts may begin by studying the growth of sales volume in several different cities. This growth may then be traced to increases in population, size of the company's sales force, or amount of money spent on advertising. Other marketing research workers may study changes in the quantity of company goods on store shelves or make door-to-door surveys to obtain information on company products.

Marketing research workers are often concerned with customer's opinions and tastes. For example, to help decide on the design and price of a new line of television sets, marketing research workers may survey consumers to find out what styles and price ranges are most popular. This type of survey usually is supervised by marketing researchers who specialize in consumer goods; that is, merchandise sold to the general public. They may be helped by statisticians who select a group (or sample) to be interviewed and "motivational research" specialists who phrase questions to produce reliable information. Once the investigation is underway, the marketing research worker may supervise the interviewers. He also may direct the office workers who tabulate and analyze the information collected.

Marketing surveys on products used by business and industrial firms



Marketing research worker reviews results of survey.

may be conducted somewhat differently from consumer goods surveys. The marketing researcher often conducts the interviews himself to gather opinions of the product. He also may speak to company officials about new uses for it. He must therefore have specialized knowledge of both marketing techniques and the industrial uses of the product.

Places of Employment

About 25,000 full-time marketing research workers were employed in 1972; most were men. They included research assistants and others in junior positions as well as supervisors and directors of research. In addition, a limited number of other professionals (statisticians, economists, psychologists, and sociologists) and several thousand clerical workers were employed full time in this field. Thousands of additional workers, many of them women, worked part time or on a temporary basis as survey interviewers.

Most jobs for marketing research workers are found in manufacturing companies and independent advertising and research organizations. Large numbers also are employed by stores, radio and television firms, and newspapers; others work for university research centers and govment agencies. Marketing research organizations range in size from one-man enterprises to firms having a hundred employees or more.

The largest number of marketing research workers is in New York City, where many major advertising and independent marketing research organizations are located, and where many large manufacturers have their central offices. The second largest concentration is in Chicago. However, marketing research workers are employed in many other cities—wherever there are central offices of large manufacturing and sales organizations.

Training, Other Qualifications, and Advancement

Although a bachelor's degree is the usual entry requirement for marketing research trainees, graduate training is becoming important for some specialized positions and for advancement to higher level positions. Many graduates qualify for jobs through previous experience in other types of research, while employers may hire university teachers of marketing or statistics to head new marketing research departments.

College courses considered to be valuable preparation for work in marketing research are statistics, English composition, speech, psychology, and economics. Some marketing research positions require skill in specialized areas, such as engineering, or substantial sales experience and a thorough knowledge of the company's products. Knowledge of data processing is helpful because of the growing use of computers in sales forecasting, distribution, and cost analysis.

Trainees usually start as research assistants or junior analysts. At first, they may do considerable clerical work, such as copying data from published sources, editing and coding questionnaires, and tabulating survey returns. They also learn to conduct interviews and write reports on survey finding. As they gain experience, assistants and junior analysts may assume responsibility for specific marketing research projects, or advance to supervisory positions. An exceptionally able worker may become marketing research director or vice president for marketing and sales.

Either alone or as part of a team, marketing research workers must be resourceful as they analyze problems and apply various techniques to their solution. As advisers to management, they should be able to write clear reports informing company officials of their findings.

Employment Outlook

College graduates trained in marketing research, and statistics will find favorable job opportunities in this occupation through the mid-1980's. The growing complexity of marketing research techniques also will expand opportunities for psychologists, economists, and other social scientists. Job opportunities for those who hold master's and doctor's degrees will be excellent.

The demand for marketing research services is expected to increase very rapidly through the next decade. Existing marketing research organizations will expand and new marketing research departments and independent firms will be set up. Business managers will find it increasingly important to obtain the best information possible for appraising marketing situations and planning marketing policies. Also, as marketing research techniques improve and more statistical data accumulate, company officials are likely to turn more often to marketing research workers for information and advice.

Earnings and Working Conditions

Starting salaries for market research trainees averaged about $9,000 a year in 1972, according to the limited data available. Persons having masters degrees in business administration and related fields usually started with annual salaries close to $13,000.

Earnings were greater for experienced marketing research workers who held management positions of high responsibility. Vice presidents of marketing and directors of marketing research often earned between $25,000 and $35,000 a year.

Marketing research workers usually work in modern, centrally located offices. Some, especially those employed by independent research firms, do a considerable amount of traveling in connection with their work. Also, they may frequently work under pressure and for long hours to meet deadlines.

Sources of Additional Information

Additional information on careers in marketing research is available from:

American Marketing Association, 230 North Michigan Ave., Chicago, Ill. 60601.

PERSONNEL WORKERS

(D.O.T. 166.088 through .268)

Personnel worker administers test to job applicant.

Nature of the Work

Attracting the best employees available and matching them to jobs they can do effectively are important for the successful operation of business and government. Personnel workers interview, select, and recommend applicants who have the education and experience to fill vacancies. In addition to staffing, they counsel employees, plan training, develop wage and salary scales, and investigate methods to improve personnel operations. Some jobs require only limited contact with people; others involve frequent contact with employees, union representatives, job applicants, and other people outside the organization.

Large organizations employ personnel workers at varying levels of responsibility. Department heads formulate policy, advise company officials on personnel matters, and administer the work of their staffs. Supervisors and specialists in wage administration, training, safety, and job classification direct the work of staff assistants and clerical employees. Small organizations employ relatively few personnel workers; sometimes one individual performs personnel duties in addition to other work.

Personnel workers in government agencies generally do the same kind of work as those in large business firms. Government personnel workers, however, spend considerably more time classifying jobs, and devising, administering, and scoring competitive examinations given to job applicants.

Places of Employment

In 1972, about 235,000 people—three-fourths of them men—were personnel workers. Well over half worked in private industry including banks, telephone companies, and department stores. Large numbers also worked in Federal, State, and local government agencies. A few were in business for themselves, often as management consultants or employee management relations experts. In addition, some taught college or university courses in personnel administration, industrial relations, and similar subjects.

Most jobs for personnel workers are located in the highly industrialized sections of the country.

Training, Other Qualifications, and Advancement

A college education is becoming increasingly important for personnel work. Many employers in private industry prefer applicants who have majored in business or personnel administration; people inter-

ested in working for the government should major in public administration, political science, or personnel administration. However, those with other majors also are eligible for government positions.

For some positions, specialized training may be necessary. Testing and counseling often require a bachelor's degree with a major or graduate degree in psychology. An engineering degree may be desirable for work dealing with time studies or safety standards, and training in industrial relations may be helpful for work involving employee management relations. An accounting background is useful for positions concerned with wages, pensions, and other employee benefits.

Although most employers seek college graduates to work in personnel, some prefer workers who already have firsthand knowledge of operations, regardless of their educational preparation. Large numbers now in personnel work who are not college graduates entered the field this way.

New workers usually enter formal or on-the-job training programs to learn how to classify jobs, interview applicants, or perform other personnel functions. After training, they are assigned to work in specific areas.

Personnel workers should speak and write effectively and be able to work with people of all levels of intelligence and experience. They also must be able to see both the employee's and the employer's points of view. In addition, personnel workers should be able to work as part of a team. They need supervisory abilities and must be able to accept responsibility. A personnel worker should like detail, be persuasive, and have a congenial personality.

After gaining experience, personnel workers usually can advance within their own organization or transfer to other employers. Those in the middle ranks of a big organization often transfer to a top job in a smaller one. Employees with exceptional ability usually are promoted to executive positions, such as personnel director.

Employment Outlook

The number of personnel workers is expected to expand very rapidly through the mid-1980's as employers recognize the need for trained personnel to maintain good employee relations. In addition to new jobs created by growth, many openings will become available each year to replace workers who die, retire, or leave the occupation for other reasons. People trained in psychological testing and in handling work-related problems will find particularly good job prospects. Advancement to personnel positions from production, clerical, or subprofessional jobs will be limited.

Earnings and Working Conditions

Beginning personnel workers in private industry started at $9,500 a year in 1972, according to a Bureau of Labor Statistics survey in urban areas. Experienced workers earned $15,000, about twice as much as the average for all nonsupervisory workers in private industry, except farming. Directors of personnel earned between $14,300 and $24,700 a year; some top personnel and industrial relations executives in large corporations earned considerably more.

In the Federal Government, inexperienced graduates with bachelor's degrees earned $7,700 a year in early 1973; those having exceptionally good academic records or one year of graduate work began at $9,500. Inexperienced workers having a master's degree and a high class standing started at $11,600 a year. Personnel workers having high levels of administrative responsibility and several years of experience earned more than $16,500; some in charge of personnel for major departments in the Federal Government earned more than $26,800 a year.

Employees in personnel offices generally work 35 to 40 hours a week. During a period of intensive recruitment or emergency, they may work much longer. As a rule, personnel workers are paid for holidays and vacations, and share in the same retirement plans and other benefits available to all professional workers in their organizations.

Sources of Additional Information

General information on careers in personnel work may be obtained from:

American Society for Personnel Administration, 19 Church St., Berea, Ohio 44017.

General information about government careers in personnel is available from:

International Personnel Management Association, 1313 East 60th St., Chicago, Ill. 60637.

PUBLIC RELATIONS WORKERS

(D.O.T. 165.068)

Nature of the Work

How successfully an organization presents itself may affect its public acceptance and influence. Public relations workers help an employer build and maintain a beneficial public image. To accomplish this,

they must understand changing attitudes and opinions of customers, employees, and other groups.

Public relations departments are found in many different organizations, so that workers must tailor their programs to an employer's particular needs. For example, a public relations director for a small college may devote most of his energies to attracting additional students, while one in a business firm may handle the employer's relationship with stockholders, government agencies, and community groups.

Public relations workers gather and give out information that keeps the public aware of their employer's projects and accomplishments. They prepare and assemble information and contact the people who may be interested in publicizing their material. Many newspaper items, magazine articles, and pamphlets giving information about a company start at public relations workers' desks.

Public relations workers also arrange and conduct direct public contact programs. Such work includes setting up speaking engagements for officials and writing the speeches they deliver. These workers often serve as an employer's representative during community projects and occasionally show films at school assemblies, plan conventions, or manage fund-raising campaigns.

Public relations staffs in large firms sometimes number 200 or more. The director of public relations may develop overall plans and policies with a company vice-president or another executive having the authority to make final decisions. In addition, large public relations departments employ writers, research workers, and other specialists who prepare material for the different media or write reports sent to stockholders.

Workers who handle publicity for an individual or direct public relations for a university or small business may do all aspects of the job. They make contacts with outsiders, do the necessary planning and research, and prepare material for publication. These workers may combine public relations duties with advertising or managerial work; some are top-level officials and others have lower level positions. The most skilled public relations work of making overall plans and maintaining contacts usually is done by the department director and highly experienced staff members.

Public relations worker checks material for press release.

Places of Employment

More than 85,000 persons—nearly one-third women—were public relations workers in 1972. In recent years, an increasing number of women have entered the field. Manufacturing firms, stores, and trade and professional associations hire the majority of public relations workers. Others work for consulting firms furnishing public relations services to clients for a fee.

Public relations workers are concentrated in large cities where press services and other communications facilities are readily available, and where many businesses and trade associations have their headquarters. More than half of the public relations consulting firms in the United States are in New York City, Los Angeles, Chicago, and Washington, D.C.

Training, Other Qualifications, and Advancement

A college education or journalism experience generally is the best preparation for public relations work. Although most workers major in public relations, journalism, or English, some employers prefer a background in science or some field related to the firm's business. Others, especially small firms, want college graduates with secretarial skills who can combine clerical duties with public relations. Still others want college graduates with at least one year's experience working for the news media. After a few years' experience, these workers may advance to full-time public relations jobs.

In 1972, over 80 colleges and more than 30 graduate schools offered degree programs or special curriculums in public relations. In addition, nearly 200 colleges offered at least one course in this field.

Courses in journalism, business administration, psychology, and public speaking help in preparing for a public relations career. Extracurricular activities, such as writing for a school publication, give valuable experience. Part-time or summer jobs in selling or public relations provide training that can help overcome competition for entry positions.

Creativity, initiative, and the ability to express thoughts clearly and simply are important to the public relations worker. Fresh ideas are so vital in public relations that some experts spend all their time developing new ideas with management, leaving the job of carrying out programs to others.

A person choosing public relations work as a career needs an outgoing personality, self-confidence, and an understanding of human psychology. He should have the enthusiasm necessary to motivate people. Public relations workers need a highly developed sense of competitiveness and the ability to function as part of a team.

Some companies—particularly those with large public relations staffs—have formal training programs for new workers. In other firms, new employees learn by working under the guidance of experienced staff members. Beginners often maintain files of material about company activities, scan newspapers and magazines for appropriate articles to clip, and assemble information for speeches and pamphlets. After gaining experience, they work on progressively more difficult assignments such as writing press releases, speeches, and articles for publication.

Promotion to supervisory jobs may come as the worker shows he can handle more difficult and creative assignments. Some experienced public relations workers start their own consulting firms.

Employment Outlook

Employment of public relations workers is expected to increase moderately through the mid-1980's. In addition to new jobs created as expanding organizations require more public relations specialists, openings will occur because of the need to replace workers who leave the field.

The demand for public relations workers will grow as population increases and the general level of business activity rises. In recent years, public relations spending has increased, and many organizations have developed new public relations departments. This trend should continue in the years ahead.

Earnings and Working Conditions

Starting salaries for men beginning public relations work averaged $9,000 a year in 1972, according to the limited data available; entry salaries for newly hired women averaged $6,900 a year. Many experienced public relations workers earned from $15,000 to $25,000 and more a year.

The salaries of experienced workers generally are highest in large organizations having extensive public relations programs. Directors of public relations for medium-sized firms earned $15,000 to $30,000 a year; those at large companies had salaries in the $20,000 to $50,000 range. Salaries for some officials, such as vice-presidents in charge of public relations, can range from $25,000 to $75,000 a year or more. The median salary for directors of public relations was $21,000 in 1972.

Many consulting firms employ large staffs of experienced public relations specialists and often pay somewhat higher salaries than other business organizations. In social welfare agencies, nonprofit organizations and universities, salaries generally are lower.

Although the workweek for public relations staffs usually is 35 to 40 hours, overtime may be necessary to prepare or deliver speeches, attend meetings and community activities or travel out of town. Occasionally, the nature of their regular assignments or special events requires public relations workers to be on call around the clock.

Sources of Additional Information

Further information about the nature of public relations work is available from:

Service Department, Public Relations News, 127 East 80th St., New York, N.Y. 10021.

Research Department, PR Reporter, Meriden, N.H. 03770.

For additional career information and a list of schools offering degrees

and courses in the field write:

Career Information, Public Relations Society of America, Inc., 845 Third Ave., New York, N.Y. 10022.

PURCHASING AGENTS

(D.O.T. 162.158, 180.118, 191.118, and 252.358)

Nature of the Work

If materials, supplies, or equipment are not on hand when needed an organization's work may be interrupted or halted. Maintaining an adequate supply of items a firm needs to operate is the purchasing agent's job.

Purchasing agents and their assistants obtain goods and services of the required quality at the lowest possible cost, and see that adequate supplies are kept on hand. Agents who work for manufacturing firms buy machinery, raw materials, and product components; those working for government agencies may purchase office supplies, furniture, and business machines. ("Buyers" who purchase merchandise for resale in its original form are not included in this statement.)

Purchasing agents buy when stocks on hand reach a predetermined reorder point, or when a department in the organization requisitions items it needs. Because agents usually can purchase from many sources, their main job is selecting the seller who offers the best value.

Purchasing agents use a variety of means to select among suppliers. They compare listings in catalogs and trade journals and telephone suppliers to get information. They also meet with salesmen to examine samples, watch demonstrations of equipment, and discuss items to be purchased. Sometimes agents invite suppliers to bid on large orders; then they select the lowest bidder among those who meet requirements for quality of the goods and delivery date.

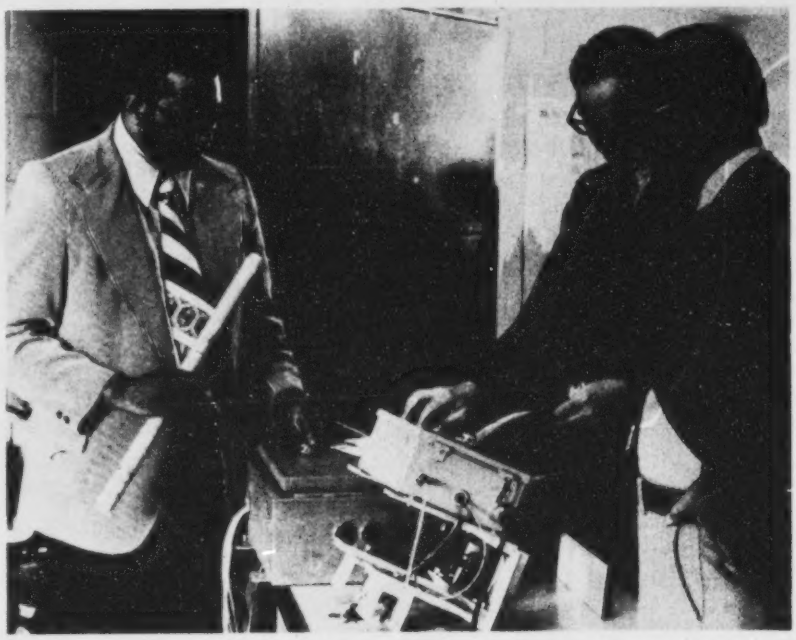
It is important that purchasing agents develop good business relations with their suppliers. This can result in savings on purchases, favorable terms of payment, and quick delivery on rush orders or material in short supply. They also work closely with personnel in various departments of their own organization. For example, they may discuss product specifications with company engineers or shipment problems with workers in the shipping and receiving or traffic departments.

Once an order has been placed with a supplier, the purchasing agent makes periodic checks to insure that it will be delivered on time. This is necessary to prevent work flow interruptions due to lack of materials. After an order has been received and inspected, the purchasing agent authorizes payment to the shipper.

Because of its importance, purchasing usually is designated as a separate responsibility within a firm. In a large firm, the head of the purchasing department directs the work of a staff which includes assistant purchasing agents and clerical workers. Assistants may purchase certain categories of goods, such as raw materials or office supplies, or specialize in buying specific items—for example, steel, lumber, cotton, or oil.

Places of Employment

About 180,000 persons—90 percent of them men—were purchasing agents in 1972. Nearly half worked in manufacturing industries. Large numbers also were employed by government agencies, construction companies, hospitals, and schools.



Purchasing agents examine sample equipment.

Most purchasing agents work in firms that have fewer than 10 employees in the purchasing department. Some large firms, however, may have a hundred or more specialized buyers.

Training, Other Qualifications, and Advancement

Many large employers seek college graduates for beginning positions as purchasing agents. Although companies that manufacture complex machinery or chemicals may prefer a background in engineering or science, other firms hire business administration or liberal arts majors for trainee jobs. Courses in accounting, economics, and purchasing are helpful. Many small firms prefer experience with the company, and select purchasing workers from among their own personnel, whether or not they have a college education. For advancement to high-level positions, however, a college degree is becoming increasingly important.

Regardless of previous training, the beginning purchasing agent must spend considerable time learning about his company's operations and purchasing procedures. He may be assigned to the storekeeper's section to learn about purchasing forms, inventory records, or storage facilities. Next he may work with an experienced buyer to learn about types of goods purchased, prices, and suppliers.

Following the initial training period, a trainee often becomes a junior buyer of standard catalog items. As he gains experience and exercises good judgment in the various aspects of purchasing, he may be promoted to assistant purchasing agent and then to purchasing agent. Some agents advance to positions as vice presidents of purchasing or procurement officers.

The purchasing agent must be able to analyze numbers and technical data in order to make buying decisions and take responsibility for spending large amounts of company money. The job requires the ability to work independently and a good memory for details. In addition, a purchasing agent must be tactful in dealing with salesmen and able to motivate others.

Employment Outlook

A moderate increase in the employment of purchasing agents is expected through the mid-1980's. In addition to job openings resulting from growth, many opportunities are expected annually because of the need to replace personnel who retire, transfer, or leave the field for other reasons.

Major factors underlying this growth include the continued increase in the size of business and manufacturing firms and the development of new products and sources of supply such as foreign markets. In particular, the ever-increasing complexity and specialization of business functions and products will spur demand for purchasing agents with knowledge in specific areas.

Earnings and Working Conditions

College graduates hired as purchasing trainees in large firms earned from $7,500 to $8,500 a year in 1972, according to the limited data available. In the Federal Government, beginning purchasing agents who had college degrees earned $7,700 or $9,500 in early 1973, depending on scholastic achievement and performance on the Federal Service Entrance Examination.

In 1972, experienced agents purchasing standard items averaged more than $10,500; buyers purchasing complex or technical goods averaged more than $15,000. Some top purchasing executives earned over $45,000 a year. Purchasing agents earn about one and one-half times as much as the average for all nonsupervisory workers in private industry, except farming.

Sources of Additional Information

Further information on education and training is available from:

National Association of Purchasing Management, 11 Park Place, New York, N.Y. 10007.

SERVICE OCCUPATIONS

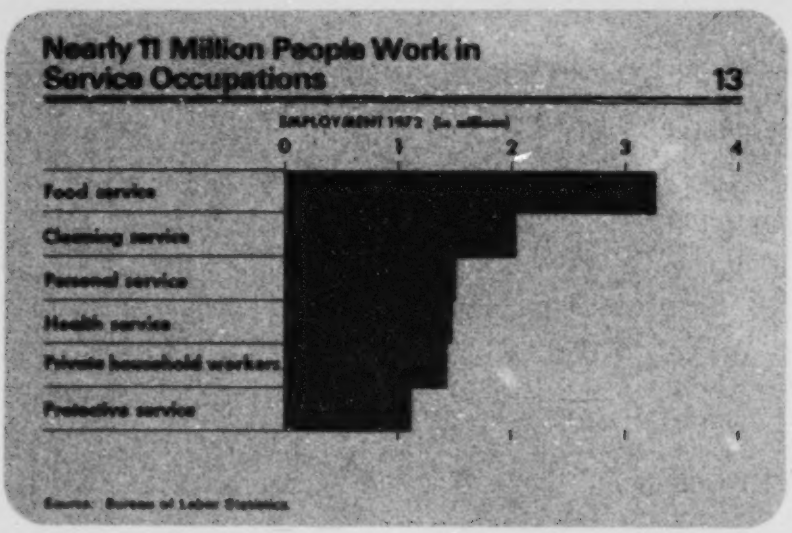
Workers in service occupations police streets, serve food, put out fires, clean homes and buildings, and provide services to the American people in many other ways. In 1972 approximately 11 million service workers were employed in a wide range of occupations that included babysitters, policemen, cooks, hospital attendants, theater ushers, barbers, and buildings custodians. The major groups of service workers are discussed below:

Food service occupations. In 1972, more than 3.0 million people, or about 1 in 3 service employees, worked in this group that includes cooks and chefs, kitchen workers, waiters and waitresses, and bartenders. These workers are employed in hotels, restaurants, hospitals, schools, and plant cafeterias.

Cleaning and related occupations. Over 2 million persons who clean and provide other services in buildings made up the second largest group of service workers in 1972. This group includes building custodians, chambermaids, and exterminators.

Private household service occupations. About 1.7 million people were private household service workers in 1972. Most performed domestic tasks that are familiar to all homemakers—preparing and serving meals, making beds, cleaning and doing laundry, and caring for children. Private households also require the services of workers in other occupations including gardeners, chauffeurs, private secretaries, and nurses.

Protective and related service workers safeguard lives and property. More than 1 million people, or about one-tenth of all service workers, were in protective service occupations in 1972. The majority were policemen, guards, or firemen. Most policemen and detectives are government employees, but some work for hotels, stores, and other businesses. Guards and watchmen, another large group of protective service employees, work chiefly for private companies to protect their property and enforce company rules and regulations. Firemen, also a significant group of protective service employees, work mainly for city governments. The remaining protective service workers are sheriffs and bailiffs, crossing watchmen and bridge tenders, and marshals and constables.



Over 3 million additional service workers provide health care, grooming and personal services, or work in occupations related to entertainment and leisure time activities. About half this number worked in health service occupations, including hospital attendants and nurse aides. Occupations concerned with grooming and personal services, such as barbers and cosmetologists, provided employment for over 700,000 workers. More than 100,000 were in occupations related to entertainment, including ski instructors and ushers.

The sections that follow have detailed statements for cleaning, food, personal, private household, and protective service occupations. In-

formation on other service occupations is given in the industry statements on government; transportation, communications, and public utilities; service and miscellaneous; and wholesale and retail trade; the section on health occupations; and the statements on Exterminators, Meat Cutters, and Funeral Directors elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Training and skill requirements differ greatly among the various service occupations. FBI special agents, for example, must have a college degree. Barbers and beauty operators need specialized vocational training. Still other occupations—general maid, waitress, and hotel bellman, for example—have no specific educational requirements for entry, although a high school diploma is always an advantage. The Federal Government sponsors training for many service occupations under provisions of the Manpower Development and Training Act and other legislation.

For many service occupations, personality traits and special abilities may be as important as formal schooling. Thus, physical strength and endurance are a necessity for work as a porter, life guard, or window cleaner; and a pleasing manner and appearance are especially important for the theater usher, elevator operator, and checkroom girl. Other service workers, such as store and hotel detectives and travel guides, need good judgment and should be skillful in dealing with people.

Some service workers eventually go into business for themselves as caterers or restaurant operators, for example, or proprietors of barber or beauty shops. Advanement from service occupations that require little training or skill may be difficult for people without a good basic education and some knowledge of the business in which they work.

Employment Trends and Outlook

In the last decade, the number of workers in service occupations grew at about the same rate—20 percent—as the labor force as a whole. Since the beginning of the 1970's, however, service workers have increased substantially faster than the total labor force. The number of private household workers, however, has continued the downtrend begun in the 1960's, despite a strong demand for their services.

Employment in service occupations is expected to expand moderately to the mid-1980's as income levels rise and leisure time increases. As total employment rises, however, various occupations within the service group are likely to be affected differently—some growing very rapidly, others only moderately, and a few decreasing in size.

Most of the future employment increase is expected to be among policemen and other protective service workers; attendants in hospitals and businesses that offer professional and personal services; beauty operators; and cooks, waiters, and others who prepare and serve meals outside the home. Some of the factors responsible for employment growth in these occupations are: the greater need to protect life and property as urbanization continues and cities become more crowded; the added medical care required by a growing and aging population; and the more frequent use of restaurants, beauty parlors, and other services as income levels rise and an increasing number of housewives take jobs outside the home.

Although jobs for service workers are found throughout the country, firefighters, hospital attendants, hotel service employees, and amusement and recreation attendants work chiefly in larger towns and cities.

CLEANING AND RELATED OCCUPATIONS

The need for cleaning workers coincides with the continued growth of urban centers. As more hospitals, office buildings, hotels, and apartment houses are built, large numbers of people are needed to clean and maintain these structures.

Workers in cleaning and related occupations usually gain their skills on the job, but some learn through specific training courses. Hotel housekeepers and assistants, for example, often take courses in housekeeping procedures and interior decorating. Other cleaning workers participate in training offered by unions and government agencies.

In addition to knowing the duties of their jobs, cleaning employees should have certain personal traits. Exterminators, for example, must be courteous, tactful, and neat because they deal constantly with the public. Building custodians should be able to withstand the tiring and monotonous routine of their jobs.

This section describes 3 cleaning and related occupations: Building Custodians, Exterminators, and Hotel Housekeepers and Assistants.

BUILDING CUSTODIANS

(D.O.T. 187.168, 381.137 and .887; 382.884, 891.138)

Nature of the Work

Building custodians, sometimes called janitors or cleaners, maintain hotels, hospitals, office buildings, apartment houses, and other buildings.

Custodial workers see that heating and ventilating equipment work properly, keep the building clean and orderly, and do other tasks that keep a building in good condition. On a typical day, a custodian may wet- or dry-mop floors, vacuum carpets, clean furniture and other equipment, make minor repairs, and exterminate insects and rodents. (See the statement on Exterminators elsewhere in the *Handbook* for more information on this occupation.)

Custodians use many different tools and cleaning materials. For one job, they may need only a simple mop; for another, they may use an electric polishing machine and a special cleaning compound. Chemical cleaners and power equipment have reduced the effort needed for cleaning jobs. Custodians must be familiar with cleaning equipment and materials designed for specific tasks because improper use of a chemical cleaner or machine may harm surfaces.

Some custodians supervise the cleaning and maintenance of an entire building or section of a building, and see that jobs, such as floor waxing or furniture polishing, are done well.

Places of Employment

In 1972, about 1.9 million people—75 percent of them men—worked as building custodians. Although jobs for custodians are found in cities and towns throughout the Nation, the majority work in the more populated areas of the country.

Many building custodians are employed by hospitals, hotels, factories, and retail stores. Large numbers also work in apartment houses and office buildings; some are employed by contract firms that provide building maintenance service for a fee.

Training, Other Qualifications, and Advancement

No special education is required for most custodial jobs, but the beginner should know simple arithmetic and be able to follow instructions. High school shop courses are helpful to the building service worker who does various handyman tasks, such as minor plumbing or carpentry.

Most building custodians learn their skills on the job. Usually, beginners do routine cleaning. As

Building custodian replaces light fixture.

workers gain experience, they are given more complicated duties.

In some cities, unions and government agencies have programs to teach necessary skills to building custodians. Students learn about the different kinds of surfaces in modern buildings and ways to clean them. They learn to operate and maintain machines, such as wet and dry vacuums, buffers, and polishers. They also receive instructions concerning minor electrical, plumbing, and other repairs. Students learn to plan their work, to deal with the public, and to work independently without supervision. A few training programs offer remedial courses in reading, writing, and arithmetic.

Advancement opportunities for custodial workers may be limited because the custodian often is the only maintenance worker in a building. Where there is a large maintenance staff, however, custodians can be promoted to supervisory jobs. For advancement to supervisor, a high school diploma is helpful. Some custodians become self-employed and maintain building for clients on a fee basis, after becoming thoroughly familiar with the work.

Building custodians usually find work by answering newspaper advertisements or by applying directly to a company. They also get jobs through State employment offices. For government positions, an employment application must be filled out and the civil service personnel headquarters contacted.

Employment Outlook

Employment of building custodians is expected to rise moderately through the mid-1980's as the construction of apartment houses, motels, and other buildings that use custodial services expands. The growth of the condominium as a form of home ownership also will contribute to the favorable outlook for these workers. In this kind of dwelling unit, custodians perform much of the maintenance formerly done by the homeowner.

In addition to the large number of new jobs that will be created, thousands of workers will be needed each year to replace experienced custodians who retire, die, or leave for other reasons.

Earnings and Working Conditions

Earnings of building custodians vary by industry and area of the country; workers in large cities of the North Central region earn the highest wages. In 1971–72, custodians in private industry had the following average hourly earnings, according to a Bureau of Labor Statistics survey in urban areas:

Industry	*Average hourly earnings*
Manufacturing	$3.23
Public Utilities	3.33
Wholesale Trade	2.80
Retail Trade	2.37
Finance	2.68
Services	2.32

In general, custodial workers earn about three-fourths as much as the average earnings for all nonsupervisory workers in private industry, except farming.

In the Federal Government, building custodial workers' pay rates are similar to those paid by private industries in the same local areas.

Most building service workers receive paid holidays and vacations, and health insurance.

Although custodians usually work inside heated, well-lighted buildings, sometimes they work outdoors sweeping walkways, mowing lawns, or shoveling snow. Those who maintain machinery and heating systems may work in noise and grease. Custodial workers often suffer from minor cuts, bruises, and burns caused by machines, hand tools, and chemicals. An additional hazard of custodial work is heavy lifting.

Building custodians stand up most of the time at work. Many tasks, such as dusting or sweeping, require constant bending, stooping, and stretching. Some must clean buildings after the regular staff has left for the day. To provide 24-hour maintenance, custodians may be assigned shift work.

Sources of Additional Information

Information about opportunities in custodial work and training under provisions of the Manpower Development and Training Act and other legislation may be obtained from the local office of your State employment service

General information on job opportunities and wage rates in local areas may be obtained for this occupation from:

Service Employees International Union, 900 17th St. NW., Washington, D.C. 20006.

EXTERMINATORS

(D.O.T. 389.781 and 389.884)

Nature of the Work

Rats, mice, and common household insects, such as flies and roaches, contaminate food and spread sickness; termites can eat away houses. Eliminating these pests from homes and businesses is the job of professional exterminators who are classified either as pest-control routemen or termite treaters. Although these fields of work are

separate, many exterminators do both.

Routemen service restaurants, hotels, food stores, and other customers who have problems with rats, mice, and common household insects. Since these pests can be difficult to stamp out, many customers have contracts for regular service. Routemen serving such commercial accounts may visit a dozen or more locations in one day, and return to most of them two weeks to a month later. Service to homes may require only one to three visits per year. Routemen usually work alone.

Termite treaters, on the other hand, may spend one or more days servicing a single building. Additional visits are seldom necessary, because a treatment usually keeps termites away for many years. Treaters frequently work in pairs or are assisted by helpers.

On a typical day at the office, exterminators load their trucks or cars with chemical pesticides and other supplies and receive written instructions of services to be performed. Most customers are billed, but sometimes they pay the exterminator who keeps work records, including pesticides used and amount of time spent at each location, to be turned in to the office.

To choose the safest and most effective pesticide for each job, routemen must know the habits and hiding places of different insects and rodents, what attracts them, and how they get into buildings. Behind cabinets, under sinks, and in cracks and crevices, exterminators apply liquid pesticides, which are usually premixed, through a portable sprayer. Power bulbs are used in some areas.

Traps or poisonous baits are placed near areas where rats or mice nest. Routemen must be careful not to apply poisons around areas where food is exposed or where there would be a danger to children or pets. Most

of their work is fairly routine, but occasionally they handle an unusual job, such as removing bird nests from an attic.

Routemen tell customers how to correct conditions that attract pests. For example, they may recommend replacing damaged garbage containers, sealing open food containers, and repairing cracks in walls. Pest-control salesmen usually contact prospective customers.

Subterranean termites, the most common wood-attacking insects, live in underground colonies and build mud "commuter tubes" to reach the house above. To destroy a colony, termite treaters put a poisonous chemical barrier between it and the wooden parts of the house. One way is to treat the soil around the foundation of the house using special tools attached to a pressure pump. To block all avenues of entry, however, it is sometimes necessary to get at the soil underneath masonry surfaces, such as basement floors and brick steps. Treaters drill holes through these surfaces, and pour or pump the chemical into the holes. They seal these holes with a cement-like putty and replace any floor coverings, such as tiles, which had to be removed. Because termites cannot cross treated areas, those in the ground must find food or starve and those trapped in the house die for lack of moisture.

Treaters sometimes have to alter buildings to prevent pests from returning. For example, they may raise foundations, replace wood, install concrete flash walls, or insulate earth-to-earth contacts with concrete.

Helpers assist treaters by digging

around and underneath houses, helping set-up and operating equipment, and mixing cement, and doing general clean-up work.

Some highly experienced treaters inspect houses for termites, estimate costs, and explain the proposed work to customers. In most exterminating firms, however, the manager, supervisor, or pest control salesmen do these jobs.

Places of Employment

More than half of the estimated 25,000 exterminators employed in 1972 were pest-control routemen; the rest were termite treaters and combination routemen-treaters. Very few women held these jobs.

Most exterminators work for or own firms that specialize in pest control. A small number work for Federal, State, and local governments.

Jobs in this field can be found throughout the country. Employment, however, is concentrated in major metropolitan areas and large towns. In towns too small to support a firm that specializes in exterminating, pest control may be a part-time activity for workers in other occupations.

Training, Other Qualifications, and Advancement

Beginning exterminators are trained by supervisors and experienced workers. Many large firms also provide a few weeks of training, which includes classes on the characteristics of termites or other pests, the safe and effective use of pesticides, customer relations, and the preparation of work records. To aid beginners, many employers provide training manuals. Beginners gain practical experience by helping pest-control routemen or termite treaters on the job. Most can complete training for routine work in one of these occupations after 2 to 3 months.

About 30 States require exterminators to be licensed. In most States, the license is only for registration, but a growing number of these States require applicants to pass a written examination.

Employers prefer trainees who are high school graduates, have safe driving records, and are in good health. Many firms require their employees to be bonded; applicants for these jobs must have a record of honesty and respect for the law. Because routemen frequently deal with customers, employers look for applicants who are courteous, tactful, and well-groomed. Termite treaters need manual dexterity and mechanical ability. Some firms give aptitude tests to determine an applicant's suitability for the work.

High school courses in chemistry and business arithmetic provide a helpful background for exterminators. Students interested in becoming routemen also may benefit from courses in salesmanship. Those interested in termite treatment work can gain valuable experience by taking courses in carpentry.

Experienced workers with ability can advance to higher-paying positions, such as service manager or pest-control salesman. Those who acquire the necessary capital can open their own businesses.

The skills learned by exterminators also can be transferred to other occupations. Much of the pest-control routeman's work is similar to that of routemen who sell and deliver products to retail stores. With additional training, termite treaters can get jobs as carpenters.

Employment Outlook

Employment of exterminators is expected to grow rapidly through the mid-1980's. The need to replace experienced workers who retire or die or transfer to other occupations also will create many job openings.

Because pests reproduce rapidly and tend to develop immunity to pesticides, their control is a never-ending problem. Population growth and further congestion of metropolitan areas will add to the need for more exterminators. The deterioration of older buildings also is increasing the need for these workers, since buildings become more prone to infestation as they age.

Earnings and Working Conditions

Based on the limited information available, starting pay for inexperienced trainees ranged from $2 to $2.25 an hour in 1972. Earnings of experienced exterminators ranged from $2.50 to $4 an hour.

Some routemen are paid an hourly rate or weekly salary. Others receive a commission based upon charges to customers. Nearly all termite treaters are paid an hourly rate or weekly salary.

On the average, exterminators work 40 to 44 hours a week. During spring and summer, however, hours may be longer because pests are more prevalent. Most work is done during the day. Routemen, however, occasionally work nights because many restaurants and stores do not want them to work while customers are present.

Most firms provide holiday and vacation pay. Typically, employees receive 1 week's paid vacation after 1 year of service, 2 weeks after 2 years, and 3 weeks after 15 years. Many firms also provide paid sick leave, furnish laundered uniforms free of charge, and contribute to life and health insurance.

Exterminators work both indoors and outdoors in all kinds of weather.

They frequently lift and carry equipment and materials, but most items weigh less than 50 pounds. Routemen also do a great deal of walking. Termite treaters occasionally must crawl under buildings and work in dirty, cramped spaces. Workers in these occupations are subject to some hazards. Although most pesticides are not harmful to humans, some can cause injury if they are inhaled or left on the skin. Such injuries, however, are avoided if safety precautions are followed. Because they spend a lot of time driving, routemen have a relatively high exposure to traffic hazards. Termite treaters risk injury from power tools and sharp or rough materials in buildings.

Exterminators are on their own to a great extent. They do not work under strict supervision and, within limits, may decide how they will handle a job.

Sources of Additional Information

Further information on opportunities in this field may be available from local exterminating companies and the local office of the State employment service. General information about the work can be obtained from the National Pest Control Association, Inc., 250 W. Jersey St., Elizabeth, N.J. 07207.

HOTEL HOUSEKEEPERS AND ASSISTANTS

(D.O.T. 321.138)

Nature of the Work

Hotel housekeepers are responsible for keeping hotels or motels clean and attractive. They account for furnishings and supplies. They also hire, train, and supervise maids, linen and laundry workers, housemen, seamstresses, and repairmen. In addition, they keep employee records and perform other duties which vary by size and type of hotel.

Executive housekeeper demonstrates the proper way to make a bed.

Housekeepers employed in middle-size and small hotels not only supervise the cleaning staffs but also may do some of their work. In large hotels and smaller luxury hotels, the duties of executive or head housekeepers are primarily administrative. Besides supervising a staff that may number in the hundreds, they prepare the budget for the housekeeping department; submit reports to the manager on the condition of rooms, needed repairs, and suggested improvements; and purchase supplies and new furnishings. Some executive housekeepers employed by large hotel chains may have special assignments such as reorganizing housekeeping procedures in an established hotel or setting up the housekeeping department in a new hotel.

In many hotels, executive housekeepers are assisted by floor housekeepers who supervise the work on one or more floors. Large hotels also may employ assistant executive housekeepers. More than 16,000 persons, most of them women, worked as hotel housekeepers in 1972.

Training, Other Qualifications, and Advancement

Although no specific educational requirements exist for housekeepers, most employers prefer applicants having at least a high school diploma. Experience also is helpful in getting a job.

Training in hotel administration, including courses in housekeeping, is available at several colleges and universities. Some offer summer courses or evening classes; many receive guidance and approval from the National Executive Housekeepers Association. In addition, the American Hotel and Motel Association offers courses for classroom and individual home study. The most helpful courses deal with housekeeping; personnel management; budget

preparation; interior decoration; and the purchase, use, and care of different types of equipment and fabrics.

Executive housekeepers should be good at planning and organizing work. In addition, they must get along well with people, especially those they supervise. Housekeepers also should be able to work independently and analyze numbers and written data.

Assistant housekeepers may be promoted to executive housekeepers after several years of experience. Opportunities are limited, however, because only one executive housekeeper job is available in any hotel or motel.

Employment Outlook

Several hundred openings for hotel housekeepers and their assistants are expected each year through the mid-1980's. Although most openings will be to replace workers who die, retire, or transfer to other jobs, some new positions will become available in newly built hotels and the growing number of luxury motels.

Because established hotels usually fill vacancies by promotions from within (assistant housekeepers to executive housekeepers) outsiders will find their best job opportunities in newly built motels or hotels. Competition is likely to be keen.

See the Hotel statement elsewhere in the *Handbook* for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

FOOD SERVICE OCCUPATIONS

Food service workers make up one of the largest and fastest-growing occupational groups in the Nation's labor force. In 1972 more than 3 million of these workers were employed, mostly in restaurants, hotels, factory and school cafeterias, and catering firms. Job opportunities can be found almost everywhere, because even very small communities have roadside diners and school cafeterias.

There are no specific educational requirements for most food service work and skills usually can be learned on the job. Young persons who have less than a high school education and no previous experience often can get jobs as kitchen workers, dishwashers, or fountain workers. Also, many restaurants hire inexperienced persons as waiters and waitresses, cooks and bartenders. Experience is needed, however, to get one of these jobs in large restaurants and catering firms. A head cook or chef must have special training or many years of experience.

Many vocational schools, both public and private, offer courses in cooking, catering, and bartending.

Employment of food service workers is expected to grow moderately through the mid-1980's. The demand for these workers will increase as new restaurants, cafeterias, and bars open in response to population growth and increased spending for food and beverages outside the home. Higher average incomes and more leisure time will allow people to eat out more often.

Detailed discussions of the work, training, outlook, and earnings of waiters and waitresses, cooks and chefs, and bartenders are presented in the statements that follow.

BARTENDERS

(D.O.T. 312.878)

Nature of the Work

Cocktails range from the ordinary to the exotic and bartenders make these concoctions by combining different kinds of liquor with mixes such as soda water, bitters, fruit juices, and cream. There are dozens of combinations, and each one can be made in several ways. Because most people have a preference for a particular brand of liquor or a certain cocktail recipe, bartenders are often asked to mix drinks to suit a customer's taste.

Besides cocktails, bartenders also serve wine, draft or bottled beer, and a wide variety of nonalcoholic beverages.

Bartenders usually are responsible for ordering and maintaining an inventory of liquor, mixes, and other bar supplies. They also arrange bottles and glasses to form a display, wash glassware, and clean the bar.

In some establishments, bartenders work at service bars and simply make drinks for waiters and waitresses to serve. In others, they work at public bars and take orders, serve drinks, and collect payment from customers.

Bartenders working in large restaurants or hotels usually have barboys or *bartender helpers* (D.O.T. 312.887) to help them with their duties. These workers keep the bar supplied with liquor, mixes, and ice; stock refrigerators with wines and beer; and replace empty beer kegs with full ones. They also keep the bar area clean, polish fixtures, and remove empty bottles and trash.

Places of Employment

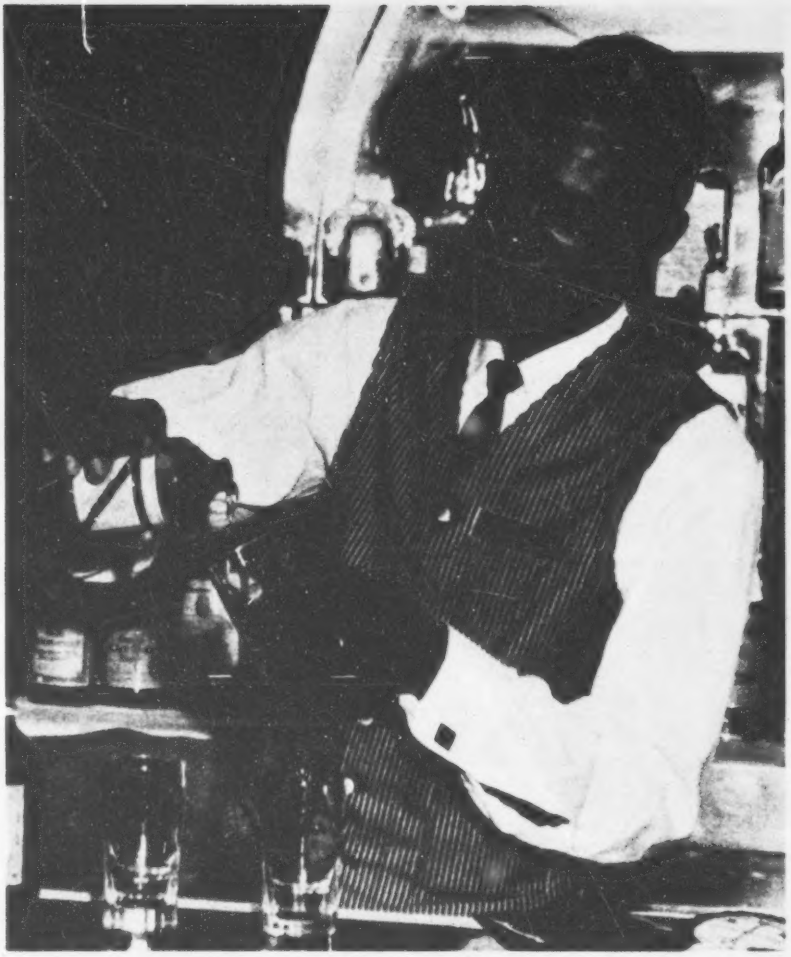
About 200,000 bartenders worked full-time in 1972, nearly one-fourth of them women. Most bartenders work in restaurants and bars, but many are also employed by hotels, entertainment and recreation places, and private clubs. Roughly one-third are self-employed.

In addition, several thousand people tend bar part time. They usually have full-time jobs in other occupations or attend college. Part-time workers often serve at banquets and private parties; usually they get these jobs through a union clearing house.

Most bartenders work in the urban population centers of New York, California, and other large States, but many are employed in small communities also. Vacation resorts offer seasonal employment, and some bartenders alternate between summer and winter resorts rather than remain in one area the entire year.

Training, Other Qualifications, and Advancement

Although preparing drinks at home can be good practice, it does not qualify a person to be a bartender. Besides knowing a variety of cocktail recipes, bartenders must know how to stock a bar properly and also must be aware of State and



local laws concerning the sale of alcoholic beverages. Most bartenders learn their trade on the job.

Young persons who wish to become bartenders can get good experience by working as barboys, busboys, or busgirls. They can watch the bartender at work, and when he has time to give instructions they can learn how to mix drinks and do other tasks. Working as a waiter or waitress also is good training.

Some private schools offer short courses in bartending that include instructions on State and local laws and regulations, cocktail recipes, attire and conduct, and stocking a bar. Some of these schools help their graduates find jobs.

Bartenders should have pleasant personalities because they deal with the public. They also need physical stamina, since they work on their feet and may have to lift heavy kegs and cases. Bartenders must be able to measure and pour ingredients quickly and accurately to turn out well-made drinks when serving large crowds.

Generally, bartenders must be at least 21 years of age, although some employers prefer those who are 25 or older. Some States require bartenders to have health certificates assuring that they are free from contagious diseases. In some instances they must be bonded.

Small restaurants, neighborhood bars, and resorts usually offer a beginner the best entry opportunities. Once he has gained experience, a bartender may wish to work in a large restaurant or cocktail lounge where he can probably earn more, and may advance to head bartender, wine steward, or beverage manager. Some bartenders open their own business.

Employment Outlook

Employment of bartenders is expected to increase moderately through the mid-1980's. In addition to those caused by employment growth, several thousand job openings will arise annually from the need to replace experienced bartenders who retire, die, or transfer to other occupations.

The demand for bartenders will increase as new restaurants, hotels, and bars open in response to population growth and increased spending for food and beverages outside the home. Higher average incomes and more leisure time will allow people to go out for dinner or cocktails more often, and to take more vacations. Also, as more women enter the labor force, families often find dining out a welcome convenience. These factors will contribute to the growing demand for bartenders.

Earnings and Working Conditions

Hourly earnings of bartenders ranged from $2.50 to $4.63 in 1972, according to limited data from union contracts in the restaurant industry. Besides wages, bartenders at public bars often receive tips that increase their earnings. Since bartenders at service bars do not receive tips, they

are often paid higher wages to compensate.

Bartenders usually receive free meals at work and may be furnished bar jackets or complete uniforms. Paid holidays and vacations are customary, as are various types of employee benefits such as health and accident insurance and pension plans.

Many bartenders work more than 40 hours a week, but there is a trend toward working fewer hours. Night- and weekend-work and split shifts are common. For many bartenders, however, the opportunity to socialize with customers and the possibility of someday managing or owning a bar or restaurant more than offset these disadvantages. For others, the opportunity to get part-time work is important.

Sources of Additional Information

Information about job opportunities may be obtained from the Hotel and Restaurant Employees and Bartenders International Union, which is the principal union organizing bartenders, and from the State employment service.

COOKS AND CHEFS

(D.O.T. 313.131 through .887; 314.381 through .878; and 315.131 through .381)

Nature of the Work

A reputation for serving fine food is an asset to any restaurant, whether it prides itself in "home cooking" or exotic foreign cuisine. Cooks and chefs are largely responsible for the reputation a restaurant acquires. Many chefs have earned fame for both themselves and the restaurants and hotels where they work because of their skill in creating new dishes and improving familiar ones.

A cook's work depends partly on the type and size of the establishment in which he works. Preparing Chinese dishes, for example, is different from charcoaling steaks. Many small restaurants offer a few short order dishes plus pies and other baked goods bought from a bakery. In these places, one cook prepares all the food with the help of a short order cook and one or two kitchen helpers.

Large eating places usually have more varied menus and prepare more of the food they serve. Kitchen staffs often include several cooks, sometimes called assistant cooks, and many kitchen helpers. Each cook usually has a special assignment and often a special job title—pastry cook, fry cook, roast cook, vegetable cook, or sauce cook, for example. The head cook or chef coordinates the work of the kitchen staff, and often takes direct charge of certain kinds of food preparation. He decides on the size of servings, sometimes plans menus, and buys food supplies. He also sees that every item on the menu looks attractive and tastes good.

Places of Employment

About 870,000 cooks and chefs were employed in 1972. Most worked in restaurants, but many worked in schools, colleges, hotels and hospitals. Government agencies, manufacturing plants, private clubs, and many other kinds of establishments also employed cooks and chefs. Three out of 5 of these workers are women.

Training, Other Qualifications, and Advancement

Most cooks acquire their skills on the job while employed as kitchen helpers. Less frequently, they are trained as apprentices under trade union contracts or in the training programs some large hotels and restaurants run for new employees. Inexperienced workers usually can qualify as assistant or fry cooks after several months of on-the-job training, but acquiring all-round skills necessary for advancement to head cook or chef in a fine restaurant often takes several years.

Young people who have had courses in restaurant cooking will have an advantage when looking for jobs in large restaurants and hotels because hiring standards are often high in these establishments. Many vocational programs—in both public and private high schools—offer this kind of training to students. Other courses, ranging from a few months to 2 years or more, and open in some cases only to high school graduates, are given under the guidance of restaurant associations, hotel management groups, trade unions, and technical schools and colleges. The Armed Forces are also a good source of training and experience in food service work. Programs to train unemployed and underemployed workers for jobs as cooks were operating in several cities in 1972 under the Manpower Development and Training Act.

Although curricula may vary, a student usually spends most of his time learning to prepare food through actual practice in well-equipped kitchens. The student learns to bake, broil, and otherwise prepare food, and to use and care for kitchen equipment. He also may be taught to select and store food, use leftovers, determine the size of portions, plan menus, and buy food supplies in quantity. Students also learn hotel and restaurant sanitation and public health rules for handling food.

Many school districts provide on-

the-job training for cafeteria workers who wish to become cooks. In addition, they may conduct workshops during the summer, and select school cooks from employees who have participated.

Young people who want to become cooks or chefs should like to work with people in a team relationship and be able to work under pressure during busy periods. Cleanliness and a keen sense of taste and smell are also important qualifications. A cook or chef in a supervisory position not only must be an expert cook, but also must be able to organize and direct kitchen operations effectively. Most States require health certificates, indicating that cooks and chefs are free from contagious diseases.

Many cooks acquire higher paying positions and new cooking skills by moving from restaurant to restaurant. Some eventually go into business as caterers or restaurant owners; others may become instructors in vocational programs in high schools, junior and community colleges, and other institutions.

Employment Outlook

Employment of cooks and chefs is expected to increase moderately through the mid-1980's. In addition to employment growth, thousands of job openings will arise annually from the need to replace experienced workers who retire, die, or transfer to other occupations.

The demand for cooks and chefs will increase as population grows and people spend more money on eating away from home. Higher average incomes and more leisure time wil allow people to go out for dinner more often, and to take more vacations. Also, as more women enter the labor force, families often find dining out a welcome convenience. These factors will contribute to the growing demand for cooks and chefs.

Small restaurants and other eating places where food preparation is fairly simple will provide the greatest number of starting jobs for cooks. Beginners who have had training in restaurant cooking, however, will be able to find jobs in hotels and restaurants where foods are prepared more elaborately.

Cook instructs trainees.

Earnings and Working Conditions

Limited wage data from union contracts in large metropolitan areas indicate that in 1972 hourly pay rates ranged from $2.83 to $5.22 for chefs, $2.46 to $4.63 for cooks of various types, and $1.89 to $4.36 for assistant cooks. Most cooks and chefs, however, are not covered by union contracts.

Wages of cooks and chefs vary depending on the part of the country and the type of establishment in which they work. Wages generally are higher in the West and in large, well known restaurants and hotels. Cooks and chefs in famous restaurants earn much more than the minimum rates and several chefs with national reputations earn more than $30,000 a year.

In addition to wages, restaurant cooks usually receive uniforms and at least one free meal a day. Paid vacations and holidays are common, and various types of health insurance programs also are provided. Hours in restaurants include late evening, holiday, and weekend work, and range from 40 to 48 hours a week. Cooks employed in public and private schools work regular school hours during the school year only, usually for 9 months.

Many kitchens are air-conditioned and have convenient work areas and modern equipment. Others, particularly in older or smaller eating places, are often not as well equipped and working conditions may be less desirable. In kitch-

ens of all kinds, however, cooks must stand most of the time, lift heavy pots and kettles, and work near hot ovens and ranges.

The principal union organizing cooks and chefs is the Hotel & Restaurant Employees and Bartenders International Union.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the Hotel & Restaurant Employees and Bartenders International Union, and local offices of the State employment service. The State employment service also may have information about the Manpower Development and Training Act and other training programs.

General information about restaurant cooks and chefs is available from the:

Culinary Institute of America, P.O. Box 53, Hyde Park, N.Y. 12538.

Educational Director, National Institute for the Food Service Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

The Educational Institute, American Hotel and Motel Association, 77 Kellogg Center, Michigan State University, East Lansing, Mich. 48823.

The Council on Hotel, Restaurant and Institutional Education, 1522 K St. NW., Washington, D.C. 20005.

MEATCUTTERS

(D.O.T. 316.781, 316.884)

Nature of the Work

Meatcutters prepare meat, fish, and poultry for sale in supermarkets or wholesale food outlets. Their primary duty is to divide animal carcasses into steaks, roasts, chops, and other serving-sized portions. They also prepare meat products such as sausage and corned beef. Meat cutters who work in retail food stores may set up counter displays and wait on customers.

In cutting a beef carcass, meatcutters divide it into halves with a band saw, and then into quarters by cutting each half between the ribs with a knife and sawing through the backbone. A special meat cutting saw is used to divide the quarters into primal cuts. Primal cuts yield only one cut of meat such as T-bone steaks or rib roasts. Meatcutters divide the primal cut into pieces small enough for an average serving.

Meatcutters use a butcher knife or slicer to divide boneless cuts and a band saw or cleaver to divide cuts containing bones. Any bone chips left on the meat are scraped off with a knife or brushed off by a machine. Meatcutters grind trimmings into hamburger.

Places of Employment

The estimated 200,000 meatcutters employed in 1972 were located in almost every city and town in the Nation. Only a small proportion were women. Most meatcutters worked in retail food stores. About 1 in 10 worked in wholesale food outlets; a few worked in restaurants, hotels, hospitals, and other institutions.

Training, Other Qualifications, and Advancement

Meatcutters acquire their skills on the job either through apprenticeship programs or informally. Generally, trainees begin by doing odd jobs, such as removing bone chips from retail cuts. Under the guidance of skilled meatcutters, they learn the

identity of various cuts and grades of meats and the proper use of tools and equipment. After demonstrating skill with tools, they learn first to divide primal cuts into individual portions and then to divide quarters into primal cuts.

In addition to learning to cut meat, beginning meatcutters may learn to cut and prepare fish and poultry, roll and tie roasts, grind hamburger, prepare sausage, and cure and corn meat. During the later stages of training, they may learn marketing operations such as inventory control, meat buying and grading, and recordkeeping.

Meatcutters who learn the trade through apprenticeship generally complete 2 to 3 years of supervised on-the-job training which may be supplemented by some classroom work. At the end of the training period apprentices are given a meatcutting test which is observed by their employer. A union member is also present in union shops. If they pass the test, apprentices become fully qualified journeyman meatcutters. If they fail, apprentices can

take the test again at a later time. In many areas of the country, apprentices may become journeymen in less than the usual training time if they can pass the meat-cutting test.

The most common method of entering this occupation is to be hired and trained by an individual retailer or wholesaler. A few meatcutters have gained entry by attending vocational schools that offer courses in meat-cutting. Unemployed and underemployed workers seeking entry jobs as meatcutters are trained in many cities under the Manpower Development and Training Act.

Employers prefer applicants who have a high school diploma and the potential to develop into meat department managers. High school or vocational school courses in business arithmetic are helpful to young people interested in becoming meatcutters, since they may be called on to weigh and price meats and to make change. A pleasant personality, a neat appearance, an the ability to communicate clearly also are important qualifications because meatcutters may wait on customers.

Manual dexterity, good depth perception, color discrimination, and good eye-hand coordination are important in cutting meat. Better than average strength is necessary since meatcutters work standing up and often lift heavy loads. In some communities, a health certificate may be required for employment.

Meatcutters may progress from journeymen to first cutter and then to a supervisory job, such as manager of the meat department in a supermarket. Some become meat buyers. Some experienced cutters open their own meat markets or retail food stores.

Employment Outlook

Little or no increase in the employment of meatcutters is expected through the mid-1980's. Nevertheless, thousands of entry jobs will be available as experienced meatcutters retire, die, or transfer to other occupations.

Central cutting, the practice of having one location at which meat for several stores is cut and wrapped, is expected to limit employment growth. Central cutting permits meatcutters to specialize in both a type of meat and a type of cut, thus increasing their efficiency. This specialization also reduces the amount of training necessary to become a cutter.

Earnings and Working Conditions

According to union contracts in six large cities, hourly earnings of most journeyman meatcutters ranged from $4.46 to $5.51 in 1972. Some meatcutters earned $6.18 an hour.

Beginning apprentices usually receive between 60 and 70 percent of the journeymen wage and generally receive increases every 6 to 8 months until they reach the journeyman level. Most meatcutters are members of the Amalgamated Meat Cutters and Butcher Workmen of North America.

Meatcutters generally work in cold rooms designed to prevent meat from spoiling. They must be careful when working with sharp tools, especially those that are powered.

Sources of Additional Information

Further information about work opportunities can be obtained from local employers or local offices of the State employment service. The State employment service also may have information about training opportunities under the Manpower Development and Training Act, apprenticeship, and other training programs. Information on training and other aspects of the trade also may be obtained from:

American Meat Institute, 59 East Van Buren St., Chicago, Ill. 60605.

Amalgamated Meat Cutters and Butcher Workmen of North America, 2800 North Sheridan Rd., Chicago, Ill. 60657.

WAITERS AND WAITRESSES

(D.O.T. 311.138 through .878)

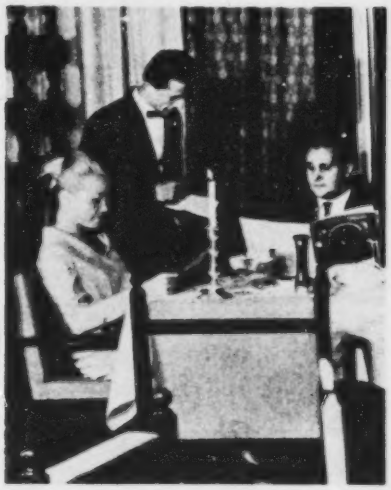
Nature of the Work

Waiters and waitresses take customers' orders, serve food and beverages, make out checks, and sometimes take payments. In diners, coffee shops, and other small restaurants they provide fast, efficient service. In other restaurants, waiters and waitresses serve food at a more leisurely pace and offer more personal service to their customers. For example, they may suggest wines and explain the preparation of items on the menu.

Waiters and waitresses may have duties other than waiting on tables. They set up and clear tables and carry dirty dishes to the kitchen. In very small restaurants they may combine waiting on tables with counter service, preparing sandwiches, or cashiering. In large restaurants and in places where meal service is formal, waiters and waitresses are relieved of most additional duties. Busboys and busgirls often set up tables, fill water glasses, and do routine tasks.

Places of Employment

About 1,120,000 waiters and waitresses were employed in 1972. Many were part-time workers. More than



80 percent of all waiters and waitresses work in restaurants, but many work in hotels, schools, and colleges.

Training, Other Qualifications, and Advancement

Most employers prefer to hire waiters and waitresses who have had at least 2 or 3 years of high school. Although most waiters and waitresses pick up their skills on the job, some public and private schools and restaurant associations offer special training for waiters and waitresses. Unemployed and underemployed workers in several cities were trained for jobs as waiters and waitresses in 1972 under provisions of the Manpower Development and Training Act.

A pleasant appearance, an even disposition, and stamina are important to waiters and waitresses. They should also be good at arithmetic and, in a few restaurants, knowledge of a foreign language is helpful. State laws often require waiters and waitresses to obtain health certificates showing that they are free of contagious diseases.

In most small eating places opportunities for promotion are limited. After gaining experience, however, a waiter or waitress may transfer to a larger restaurant where earnings and prospects for advancement are better. Advancement can be to cashier jobs or to supervisory work as a maitre d', headwaiter, or hostess. Some supervisory workers advance to managerial positions.

Employment Outlook

Employment of waiters and waitresses is expected to increase moderately through the mid-1980's. Most job openings, however, will result from the need to replace experienced workers who retire, die, or leave their jobs.

The demand for waiters and waitresses will increase as new eating and drinking places open in response to population growth and increased spending for food and beverages outside the home. Higher average incomes and more leisure time will encourage people to go out for dinner or cocktails more often and to take more vacations. Also, as more women enter the labor force families often find dining out a welcome convenience.

Eating places that employ waiters and waitresses, however, will share only part of the additional business. Some of it will be handled by food and beverage vending machines, and some will go to drug stores, variety stores, carry outs, and cafeterias where service is provided by counter and fountain workers instead of waiters and waitresses.

Waiters and waitresses seeking jobs in formal restaurants will find competition keen for the jobs that become available. Beginners will find their best opportunities for employment in the thousands of restaurants where food service is less elaborate.

Earnings and Working Conditions

Limited data from union contracts that cover eating and drinking places in several large cities indicate that straight-time hourly rates for waiters and waitresses (excluding tips) ranged from $1.11 to $2.57 in 1972. For many waiters and waitresses, tips are greater than hourly wages. Tips vary, however, depending on the skill of the waiter or waitress, tipping customs of the community, and the type of restaurant. Since tips generally average between 10 and 20 percent of guests' checks, those who work in more expensive restaurants have the highest earnings.

Most waiters and waitresses receive meals at work and many are furnished with uniforms. Paid vacations are customary and various types of health insurance and pension plans also may be available.

Waiters and waitresses often work split shifts—that is, they work for several hours during the middle of the day, take a few hours off in the afternoon, and then return to their jobs for the evening hours. They also may work on holidays and weekends. Large restaurants and dining rooms usually have convenient working areas and are often air-conditioned. Working conditions in other eating places—particularly small ones—may be less desirable. In all restaurants, waiters and waitresses stand most of the time and often have to carry heavy trays of food. During lunch and dinner hours they may have to rush to serve several tables at once. Workers also must be careful not to slip or fall, or burn themselves when handling hot food and beverages.

The principal union organizing waiters and waitresses is the Hotel and Restaurant Employees and Bartenders International Union.

Sources of Additional Information

Information about job opportunities may be obtained from local

employers, locals of the union previously mentioned, and local offices of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act and other programs that provide training opportunities. General information on waiter and waitress jobs is available from:

National Institute for the Foodservice Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

Council on Hotel, Restaurant, and Institutional Education, 1522 K St. NW., Washington, D.C. 20005.

PERSONAL SERVICES OCCUPATIONS

Personal service workers care for individuals and their belongings by performing services, including cleaning and pressing clothes, cutting hair, carrying baggage, and arranging funerals.

Training requirements vary among personal service jobs and may require state licensing. To be eligible for licensing exams, workers usually must complete an apprenticeship that may be preceded by specialized training. The length of training varies by State, but can last up to 4 years; an apprenticeship usually takes 1 to 2 years. Other jobs, such as bellman, have no specialized training.

Personal service workers should be neat, tactful, and able to get along with people. Many jobs demand physical stamina for lifting, carrying objects, and standing for long periods. Many workers wear uniforms supplied by the employer, and some must purchase their own equipment.

Personal service workers may receive salaries, commissions, or both. Many also receive tips. Part-time employment generally is good because extra workers often are hired during peak business periods.

This section describes 4 personal service occupations: Barbers, Cosmetologists, Funeral Directors and Embalmers, and Bellmen and Bell Captains.

BARBERS

(D.O.T. 330.371)

Nature of the Work

Although most men go to a barber for just a haircut, other services such as hairstyling and coloring are becoming increasingly popular. Specially trained barbers called "hairstylists," are employed in styling salons and some barber shops. They cut and style hair to suit each customer and may color or straighten hair and fit hair pieces. All barbers offer hair and scalp treatments, shaves, facial massages and shampoos.

As part of their responsibilities, barbers keep their scissors, razors, and other instruments sterilized and in good condition. They clean their work areas and may sweep the shop, as well. Those who own or manage a shop have additional responsibilities such as ordering supplies, paying bills, keeping records, and hiring employees.

Places of Employment

Most of the 160,000 barbers in 1972 worked in barber shops. More than half operated their own businesses. A small number of barbers worked for government agencies and hospitals.

All cities and towns have barbershops. Employment, however, is concentrated in large cities and in the most populous States.

Training, Other Qualifications, and Advancement

All States require barbers to be licensed. To obtain a license a person must have graduated from a State approved barber school, have completed the eighth grade, meet certain health requirements, and be at least 16 (in some States 18) years old.

Nearly all States require a beginner to take an examination for an apprentice license, and then, after 1 or 2 years of work, take a second examination for a license as a registered barber. The examinations usually include both a written test and a demonstration of ability to cut hair. Fees for these examinations range from $5 to $25. A few States do not charge a fee for the apprentice examination.

Barber training is offered in many public and private schools and a few vocational schools. Courses usually last 6 to 11 months. Trainees buy their own tools which cost about $100. They study the basic services—haircutting, shaving, massaging, and facial and scalp treatments—and, under supervision, practice on fellow students and customers in school "clinics." Besides attending lectures on barber services and the use and care of instruments, students take courses in anatomy, sanitation, and hygiene, and learn

how to recognize certain skin conditions. Instruction is also given in salesmanship and general business practices. Advanced courses are available in some localities for barbers who wish to specialize in hair styling, coloring, and the sales and service of hairpieces.

Dealing with customers requires patience and a better than average disposition. Good health and stamina also are important because a barber spends most of the time standing and works with both hands at shoulder level.

Beginners may get their first jobs through the barber school they attended, or through the local barber's union or employer's association.

Some experienced barbers advance by becoming managers of large shops or by opening their own shops. A few may teach at barber schools. Barbers who go into business for themselves must have the capital to buy or rent a shop and install equipment. Supplying a one-chair shop with new equipment usually costs from $1,500 to $2,500. Some shop owners buy used equipment and fixtures at reduced prices.

Employment Outlook

Employment of barbers should change little. Most job openings will result from the need to replace experienced barbers who retire, die, or transfer to other occupations. Replacement needs are relatively high because barbers are somewhat older, on the average, than workers in other occupations.

Employment opportunities for barbers have been limited in recent years by the trend toward longer hair. In the future, however, the effect of this trend is expected to be offset by population increases and the growing popularity of hair styling for men.

Because most barber shops will probably remain one- or two-man shops, opportunities will be best in the larger shops opening in suburban shopping centers.

Earnings and Working Conditions

Barbers receive income from commissions or wages and from tips. Most barbers who are not shop owners normally receive 65 to 75 percent of the money they take in; a few are paid straight salaries.

Weekly earnings of experienced barbers (including tips) generally ranged between $150 and $225 in 1972, according to limited information available. Some hairstylists, as well as some barbers who operated their own shops, earned more than $400 a week. Beginning barbers usually earn about $75 to $125 a week, hairstylists $125 to $200 a week.

Earnings depend on the size and location of the shop, customers' tipping habits, competition from other barbershops, and the barber's ability to attract and hold regular customers.

Most full-time barbers work more than 40 hours a week and a workweek of over 50 hours is not uncommon. Although Saturdays and lunch hours are generally very busy, a barber may have some time off during slack periods. To assure an even workload, some barbers ask customers to make appointments. Under some union contracts, barbers receive 1- or 2-week paid vacations, insurance, and medical benefits.

The principal union which organizes barbers—both employees and shopowners—is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America. The principal trade association which represents and organizes shopowners and managers is the Associated Master Barbers and Beauticians of America.

Sources of Additional Information

Information on State licensing requirements and approved barber schools may be obtained from the State Board of barber examiners or other State authority at each State capital.

General information on training facilities and State licensing laws may be obtained also from:

National Association of Barber Schools, Inc., 338 Washington Ave., Huntington, W. Va. 25701.

Additional information on this occupation is available from:

Associated Master Barbers and Beauticians of America, 219 Greenwich Rd., P. O. Box 17782, Charlotte, N.C. 28211.

Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America, 4755 Kingsway Drive #320, Indianapolis, Ind. 46205.

BELLMEN AND BELL CAPTAINS

(D.O.T. 324.138 and .878)

Nature of the Work

Bellmen, sometimes called bellboys or bellhops, carry baggage for hotel and motel guests and escort them to their rooms on arrival. For the new guest the bellman checks to see that the room is in order and may suggest the use of hotel services, such as the dining room and valet service. Bellmen also run errands and deliver packages. In smaller hotels, they may relieve the elevator operators or switchboard operator. In 1972, more than 16,000, persons—

most of them men—worked as bellhops and bell captains.

Bell captains are employed in large and medium-sized hotels to supervise bellmen. They assign work, keep time records, and train new bellmen. They also may obtain transportation information for guests and send a bellman to pick up tickets. In addition, bell captains handle complaints regarding their department and take care of unusual service requests. At times, bell captains also may perform the duties of bellmen.

Superintendents of service, who are found only in a few hotels with large service departments, supervise elevator operators, doormen, and washroom attendants, as well as bellmen and bell captains.

Training, Other Qualifications, and Advancement

Bellmen do not have to meet any specific educational requirements. High school graduation, however, improves a bellman's chances for promotion to a front office clerical job. (See the Front Office Clerk statement elsewhere in the *Handbook*.) Many hotels fill bellman jobs by promoting elevator operators.

Since bellmen have frequent contact with the public, it is important that they be neat, tactful, and courteous. A knowledge of the local community is an asset. They also must be able to stand for long periods, carry heavy baggage, and work independently.

Bellmen can advance to bell captain and then to superintendent of service, but opportunities are limited. Because there is only one bell captain position in each hotel, many years may pass before an opening occurs. Opportunities for advancement to superintendent of service are even fewer.

Employment Outlook

Employment of bellmen should remain about the same through the mid-1980's as motels, which let guests drive to their rooms, are expected to account for most of the lodging industry's growth. Most of the hundreds of yearly openings for bellmen will be to replace those who die, retire, or leave the field for other reasons. Openings also will occur in small hotels as experienced bellmen shift to jobs in luxury hotels where tips may be higher. In addition, many temporary jobs will arise in resort hotels open only part of the year.

See Hotel Industry statement elsewhere in the *Handbook* for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

COSMETOLOGISTS

(D.O.T. 332.271 and .381; 331.878 and 339.371)

Nature of the Work

Cosmetologists help their customers to look as attractive as possible. These workers, who are also known as *beauty operators, hairdressers,* or *beauticians,* shampoo, cut, set, and style women's hair; they also straighten, bleach, or tint it and give permanent waves. Cosmetologists may give manicures and scalp and facial treatments; provide makeup analysis; shape eyebrows; and clean and style wigs and hair pieces. Their duties include making appointments with customers, cleaning equipment, and sanitizing implements.

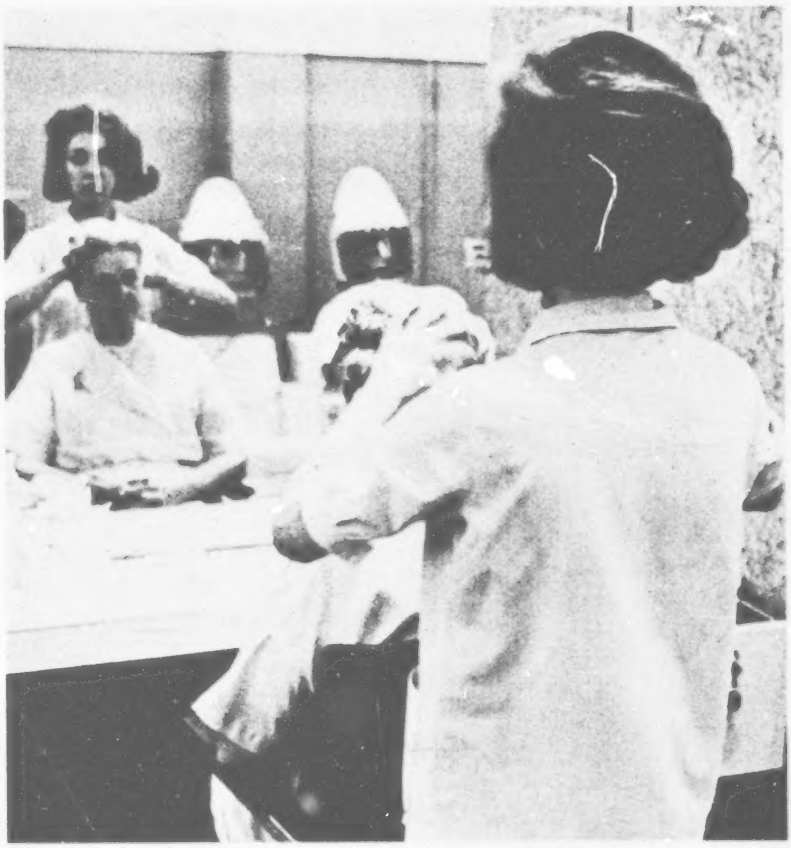
Cosmetologists may specialize in different parts of the work such as styling, manicuring, or hair tinting; many men cosmetologists specialize in styling. Self-employed beauticians have managerial duties in addition to their work as operators. They keep records, control supplies, and supervise other workers.

Places of Employment

About 495,000 persons worked as hairdressers and cosmetologists in 1972; 10 percent were men. This occupation has a relatively high proportion of part-time workers.

Although employment is concentrated in urban areas, many cosmotologists find jobs in small towns and rural areas. Most work in independently operated salons or in those connected with hotels and department or specialty stores. A few work in motion picture and television studios, hospitals, and on ocean liners.

Most beauty salons are small, having fewer than four employees; more than half are owner-operated.



Training, Other Qualifications, and Advancement

All States require that beauty operators be licensed. Before applicants are eligible to take State licensing examinations in cosmetology, they usually must be 16 years of age, present certificates of good health, and have completed the 10th grade. Many States require a high school diploma. Successful completion of a State-approved cosmetology course is recognized as adequate preparation for these examinations in all States; in some, a period of apprenticeship may be substituted. Most States provide for reciprocity which enables licensed operators in one State to work in another without taking an additional licensing examination.

About 2,800 public vocational schools and private schools offer training which meets State licensing requirements for cosmetologists. In many of them, instruction preparing students for an operator's license is available in evening classes as well as in full-time day classes. Many daytime courses offered by public and private schools require from 6 months to a year to complete. Other public school courses, which include academic subjects required for a high school diploma, last from 2 to 3 years. Apprentice training usually continues over 1 to 2 years. Many States issue special manicurists' licenses which require substantially fewer hours of training than general operators' licenses.

Both public and private school training programs include classroom study, lectures, demonstrations, and practical work. Beginning students usually work on each other or on manikins; when they have satisfactorily completed a period of preliminary training, they practice on patrons in school "clinics." Practically all beauty schools help their students find jobs after graduation.

Cosmetologists must keep abreast of changing hair styles and beauty techniques. They also need finger dexterity, a sense of form and artistry, and the physical stamina to stand for long periods of time. Beauticians should be willing and able to follow customers' instructions.

Operators usually provide their own uniforms; a few salons require them to furnish brushes, combs, and clips.

Newly hired cosmetologists start as manicurists, shampooers, or all-around operators performing a variety of tasks. Advancement usually comes in higher earnings as they gain experience and build a steady clientele or specialize in one or more phases of the work. Some experienced operators manage large salons or open their own; others teach in cosmetology schools or use their knowledge and skill to demonstrate cosmetics in department stores. A few work as inspectors for State cosmetology boards.

Employment Outlook

Employment of cosmetologists will grow rapidly through the mid-1980's as the use of beauty salons increases. Rising incomes and the growing number of women working outside the home are among the factors that will spur demand for the services cosmetologists provide.

In addition to openings from growth of the industry, thousands of workers will be needed each year to replace those who leave the occupation. Job opportunities are expected

to be good for newcomers as well as for experienced cosmetologists, and this occupation will offer many opportunities for those seeking part-time work.

Earnings and Working Conditions

Many cosmetologists are paid a salary plus commission (a percentage of receipts from their customers). Others are paid only a percentage of the receipts. A few are paid straight salary. Estimating total earnings is difficult because most cosmetologists receive tips in addition to salaries and commissions. Earnings also depend on experience, speed of performance, skill, location of the salon, and the ability to satisfy customers.

Many beginning operators earn from $100 to $200 a week, according to the limited information available. A very few top stylists and others in highly specialized jobs may earn $400 or more a week. Most full-time operators work 40 hours or more a week, usually including early evening and Saturday work. Many part-time operators also are employed during these busy periods.

In many large salons, department stores, and hotels, operators may participate in group life and health insurance and other benefit plans sponsored by the employer. Some establishments allow their employees annual paid vacations of at least 1 week after a year's service.

The most active union in this occupational field is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietor's International Union of America. Other organizations in the field are the National Hairdressers and Cosmetologists Association, Inc., which includes both shopowners and operators; The Associated Master Barbers and Beauticians of America, representing salon owners and managers; the National Association of Cosmetology Schools, Inc., representing school owners and teachers; and the National Beauty Culturists' League, made up of Negro operators, teachers, managers, and salon owners.

Sources of Additional Information

For information about approved training schools and licensing requirements, write your State board of cosmetology.

Additional facts about careers in beauty culture and State licensing requirements are available from:

National Beauty Career Center, 3839 White Plains Rd., Bronx, N.Y. 19467.

National Hairdressers and Cosmetologists Association, 3510 Olive St., St. Louis, Mo. 63103.

General information about cosmetology may be obtained from:

Journeymen Barbers International Union, 4755 Kingsway Drive #320, Indianapolis, Indiana 46205.

FUNERAL DIRECTORS AND EMBALMERS

(D.O.T. 187.168, 338.381)

Nature of the Work

Few occupations require the tact, discretion, and compassion called for in the work of funeral directors and embalmers. The families and friends of the deceased may be under considerable emotional stress and bewildered by the many details of the occasion. The *funeral director* (D.O.T. 187.168) helps them to make the personal and business arrangements necessary for the service and burial. The *embalmer* (D.O.T. 338.381) prepares the body for viewing and burial. In many instances, the funeral director and the embalmer are the same person.

The director's job begins when a call is received from a family requesting services. After arranging for the deceased to be removed to the funeral home, the director obtains the information needed for the death certificate, such as date and place of birth and cause of death. The director makes an appointment with the family to discuss the details of the funeral. These include: time and place of service; clergyman and organist; selection of casket and clothing; and provisions for burial or cremation. Directors also make arrangements with the cemetery, place obituary notices in newspapers, and take care of many other details. Directors must be familiar with the funeral and burial customs of various religious faiths and fraternal organizations.

Embalming is a sanitary and preservative measure, and under certain circumstances, such as delayed burials, is required by law. Embalmers, perhaps with the help of apprentices, first wash the body with germicidal soap and shave it if necessary. The embalming process proper replaces the blood with a preservative fluid. Embalmers apply cosmetics to give the body a natural appearance and, if necessary, restore disfigured features. Finally, they dress the body and place it in the casket selected by the family.

On the day of the funeral, directors attend to floral displays, provide cars for the family and pallbearers, receive and usher guests to their seats, and organize the funeral cortege. After the service they may help the family file claims for social security, veteran's and union benefits, and insurance. Directors may serve a family for several months following the funeral until all these matters are satisfactorily completed.

Places of Employment

About 45,000 people were licensed as funeral directors and embalmers in 1972. About 2 percent were women.

Funeral homes, which numbered 23,000 in 1972, employed nearly all of the directors and embalmers. Most funeral homes had 1 to 3 of these workers, including the owner. Many large homes, however, had 20 or more. Several hundred embalmers worked for morgues and hospitals.

Geographically, employment in these occupations is concentrated in cities.

Training, Other Qualifications, and Advancement

A license is needed to practice embalming. State licensing standards vary but generally an embalmer must be 21 years old, have a high school diploma or its equivalent, graduate from a mortuary science school, serve an apprenticeship, and pass a State board examination. One-half of the States require a year or more of college in addition to training in mortuary science.

All but six States also require funeral directors to be licensed. Qualifications are similar to those for embalmers, but directors may have special apprenticeship training and board examinations. Most people obtain both licenses. Information on licensing requirements is available from the State office of occupational licensing.

High school students can start preparing for a career in this field by taking courses in biology, chemistry, speech, and psychology. Students may find a part-time or summer job in a funeral home. Although these jobs consist mostly of maintenance and clean-up tasks, such as washing and polishing hearses, they can be helpful in gaining familiarity with the operation of funeral homes.

In early 1972, 22 schools had mortuary science programs accredited by the American Board of Funeral Service Education. About one-half were private vocational schools that offer 1-year programs emphasizing basic subjects such as anatomy and physiology, as well as practical skills, such as embalming techniques and restorative art. A small number of colleges and universities offer 2- and 4-year programs in funeral service. These programs included liberal arts and management courses as well as mortuary science. All programs offered courses in psychology, accounting, and funeral law.

Apprentices work under the guidance of experienced embalmers and directors. Depending on State regulations, an apprenticeship usually lasts 1 or 2 years and may be served before, after, or during the time one attends mortuary school.

State board examinations consist of written and oral tests and actual demonstrations of skills. After passing the examination, apprentices receive a license to practice. If they want to work in another State they may have to pass its examination, although many States have mutual agreements which make this unnecessary.

Important personal traits for funeral directors are courtesy, tact, and the ability to communicate easily with the public. They also should have the desire and ability to comfort people in their time of sorrow.

Advancement opportunities are best in large funeral homes where directors and embalmers may earn promotion to higher paying positions such as personnel manager or general manager. Some workers eventually acquire enough money and experience to establish their own businesses.

Employment Outlook

Little change in the employment of funeral directors and embalmers is expected through the mid-1980's. Nevertheless, many openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

In recent years, the number of mortuary school graduates has approximately equaled the number of jobs available. Barring any significant growth in enrollments, future graduates should find employment opportunities available.

Demand for funeral services will rise as the population grows and deaths increase. Most funeral homes, however, will be able to meet the demand without expanding their employment. Most homes conduct only one or two funerals each week and are capable of handling several more.

Earnings and Working Conditions

In 1972, funeral directors and embalmers generally earned from $150 to $250 a week. Managers generally earned between $10,000 and $15,000 a year, and many owners earned more than $20,000. Apprentices earned between $1.80 and $3.50 an hour.

In large funeral homes, employees usually have a regular work schedule. Typically they put in 8 hours a day, 5 or 6 days a week. Overtime, however, may be necessary when emergencies arise. Some employees work shifts; for example, nights one week, and days the next.

Occasionally embalmers may come into contact with contagious diseases but the possibility of their becoming ill is remote, even less likely than for a doctor or nurse.

Most directors and embalmers receive paid vacations and sick leave, retirement benefits, and life, health, and accident insurance. Some also

receive license renewal fees and suits to wear on the job.

Sources of Additional Information

Information about job opportunities in this field is available from local funeral homes and from:

National Funeral Directors Association of the United States, Inc., 135 W. Wells St., Milwaukee, Wisc. 53203.

National Selected Morticians, 1616 Central St., Evanston, Ill. 60201.

For a list of accredited schools of mortuary science and information about scholarship opportunities, contact:

The American Board of Funeral Service Education, Inc., 201 Columbia St., Fairmont, W. Va. 26554.

PRIVATE HOUSEHOLD SERVICE OCCUPATIONS

In 1972, private household service work employed 1.7 million people, most of them women. The majority were domestic workers who eased the burden of running and maintaining their employers' residences by doing any of the tasks found in those homes, such as cooking, cleaning, or caring for children. Some specialized in one aspect of household work, such as cooking; others held jobs that combined several tasks.

Private households also require the services of workers in a variety of other occupations, including gardeners, chauffers, nurses, and private secretaries. Gardeners, for example, keep the grounds of private residences neat and orderly by planting, fertilizing, and pruning flowers, trees, and shrubs. Chauffeurs drive their employers' cars, keep the vehicles clean and in good running condition, and sometimes help with other chores such as exercising pets.

Some of the most important domestic occupations found in private households, including those of maid, companion, and housekeeper, are discussed in the statement that follows. For information on the services that nurses, painters, and secretaries may perform in private households, see the statements on these occupations elsewhere in the *Handbook*.

PRIVATE HOUSEHOLD WORKERS

(D.O.T. 099.228, 301.887, 303.138 and .878; 304.887, 305.281, 306.878, 307.878, and 309.138 through .999)

Nature of the Work

Thousands of people employ private household workers to ease the burden of running and maintaining their homes. These workers perform a variety of jobs ranging from child care to cleaning and cooking. Some household occupations involve one or more related tasks while others require a mixture of many. In addition, the duties of some workers change from day to day.

The *general maid* or *mother's helper* cleans floors and bathrooms and may be responsible for meals, laundry, and child care. When hired by the hour or day, she is called a *day worker*. The *handyman* or *odd-job man* does heavy household tasks and minor household and yard maintenance. He cleans furniture, washes windows, waxes floors, paints fences, and cares for the yard. A few handymen work only in the house and sometimes are called *housemen*. If employed year-round, handymen may be known as *caretakers*.

Often private household workers specialize in one aspect of household work. *Cooks* prepare meals. Some do everything from planning the meal and ordering food to serving and cleaning the kitchen. Others get meal-planning instructions from a family member. Some cooks are aided by a *cook's helper*. The helper, who is less skilled than a cook, does things such as clean and peel vegetables or cut and grind meats. Another specialized household worker is the *laundress* who washes, irons, and folds clothing.

Some private household workers provide personal services and care for members within a household. The *personal maid* attends to a woman's needs while the *valet* attends a man. They maintain clothing, clean an employer's quarters, and help him to dress. Personal maids and valets may have additional duties including mixing drinks and running errands. *Companions* do the work of a personal maid or valet and also act as a friend or aide to a convalescent, elderly, or handicapped person. Companions may read or talk with their employer and look after social or business affairs.

Many private household workers specialize in child care. The *nursemaid*, for example, cares for the physical needs of children. She bathes them, prepares meals, washes and irons clothes, and supervises their play. *Infants' nurses* are responsible for very small children; they have additional duties connected with babies such as sterilizing bottles and other equipment and preparing formulas. *Babysitters* are nursemaids who work on a daily or hourly basis. The *governess*, who has greater responsibilities than a nursemaid, supervises children's recreation, health, and diet; she follows the parents' instruction in taking charge of their education. She also disciplines children, arranges activities, and may teach music and languages.

A household with a large staff of workers may employ a *home housekeeper* or a *butler* to supervise and coordinate domestic activities. They also may hire and fire other household employees. Butlers receive and

announce guests, answer the telephone, and serve food and drinks. They may act as valets. The housekeeper orders food and cleaning supplies and keeps a record of expenditures. Often a *working housekeeper* is the household's only employee. Her duties combine those of the general maid and housekeeper.

Places of Employment

In 1972 more than 1.4 million people were private household workers; 98 percent of them were women. Most household workers are employed part-time—a few days a week for part or all of a day. Those who live in usually work the longest hours.

Although a few specialized workers. such as laundresses or nursemaids, may work in their own homes, most jobs are found in the employer's home. Household workers are employed throughout the country, but most work in urban areas.

Training, Other Qualifications, and Advancement

For most household worker jobs there are no formal educational requirements. Instead, the ability to cook, sew, wash and iron, clean house, and care for children is important. Employers prefer workers who can operate household equipment such as vacuum cleaners and floor waxers. Often young people learn these skills while helping with the housework at home.

Some people acquire the necessary abilities by working for about a year as a mother's helper under the supervision of an experienced household worker or housewife. High schools, vocational schools, and junior colleges give home economics courses that help to develop domestic skills beyond the level ordinarily reached in the home. Training programs sponsored by Federal agencies, State employment service offices, and local welfare departments also can develop these skills.

Work experience is less important than educational and cultural background for the governess or companion. A companion's background, interests, and age should be similar to his employer's. Practical nursing experience may be helpful if the employer is an invalid. A background in the arts is useful to a governess and teaching skills are helpful for those who care for young children.

Private household workers need physical stamina and the ability to work independently. They should be able to get along with people and want to help them. In addition, they must have a neat personal appearance and like to work with their hands. Some household workers, particularly cooks and infants' nurses, need a health certificate; often the employer arranges and pays for the necessary physical examination.

With the knowledge learned at home or as a mother's helper, a woman can take a job as a general household worker or nursemaid. Advancement other than a wage increase generally is not available in households with only one or two workers. The domestic worker usually must transfer to a job requiring greater skills, such as personal maid, infant's nurse, cook or housekeeper. These opportunities are limited in number.

Employment Outlook

Although the number of private household workers is expected to

decline rapidly through the mid-1980's, thousands of openings will result each year from the need to replace those who die, retire, or leave for other reasons. Most of these jobs will be for maids and childcare workers.

The demand for services that private household workers provide will continue to grow as more women work outside the home and as family incomes increase. The decrease in the number of workers stems from low earnings and the lack of benefits as well as increasing opportunities in other lines of work. The demand for private household services will be met in part by new and improved home appliances and cleaning and child care businesses.

Earnings and Working Conditions

In 1972, full-time private household workers averages $2,478, less than half the average for non-supervisory workers in private industry, except farming.

Wages vary according to employer's income, type of work, and local pay standards. Earnings are higher in large cities, especially in the North. Workers who live in generally are paid more than those who live out and have room and board. Workers who live out may receive a free meal and transportation money.

Frequently the employee works on her own and has a key to admit herself when the employer is away. Private household work is hard at times, especially for day workers, who generally are given the less desirable household tasks. Long or irregular working hours can isolate workers who live in from family and friends, and if they are the sole employees in the households, they are likely to be alone most of the time.

Sources of Additional Information

Facts about employment opportunities and training programs in private household work are available from local offices of State employment services.

Information on laws affecting household workers and guidelines for work is available from:

National Committee on Household Employment, 1625 I St. NW., Washington, D.C. 20006.

PROTECTIVE AND RELATED SERVICE OCCUPATIONS

The growth of our Nation's population and economy demands an ever increasing emphasis on protective services. Each city, suburban area, and National port of entry requires protective and related service workers to check crime, minimize loss of life and property, and enforce regulations that protect the health and safety of our citizens.

Careers in protective and related service occupations require varied combinations of education and experience. Workers such as FBI special agents and some inspectors for the Federal government must have at least a bachelor's degree, while some guards and watchmen have less than a high school education. Most occupations in this group, however, require a high school diploma. In many cases, a college degree is an asset for advancement to higher level positions.

In addition to educational requirements, most workers in protective and related services must undergo formal training programs and get on-the-job experience before they are fully qualified. Training programs last from several days to a few months and emphasize specific job-related skills.

Personal qualifications such as honesty and an understanding of human nature are important. Persons seeking careers in protective and related service occupations should sincerely desire to serve the community and be able to exercise proper judgment under a variety of conditions.

This section describes several occupations in protective and related services, FBI Special Agents, Firefighters; State and Local Police, Guards and Watchmen, and Health, Regulatory and Construction Inspectors.

FBI SPECIAL AGENTS

(D.O.T. 375.168)

Nature of the Work

Federal Bureau of Investigation (FBI) Special Agents investigate violations of Federal laws such as bank robberies, kidnappings, frauds against the Government, thefts of Government property, espionage, and sabotage. The FBI, which is part of the U.S. Department of Justice, has jurisdiction over more than 185 Federal investigative matters. Special Agents, therefore, may be assigned to any type of case; however, those with specialized training usually work on cases related to their background. Agents with an accounting background, for example, investigate frauds involving Federal Reserve Bank records.

Because the FBI is a fact-gathering agency, its Special Agents function strictly as investigators. (The FBI does not give personal protection to individuals or do police work to insure that the law is obeyed. Such matters are handled by local and State law enforcement agencies.) To perform their duties, Special Agents may interview people, observe the activities of suspects, and participate in raids; their duties may involve extensive travel. Because the FBI's work is highly confidential, Special Agents may not disclose any of the information gathered in the course of their official duties to unauthorized persons, including members of their families. Agents may have to testify in court about cases which they investigate, but they do not make recommendations concerning prosecution or express opinions on the guilt or innocence of suspects.

Although they work alone on most assignments, agents communicate with their supervisors by radio or telephone as the circumstances dictate. In performing potentially dangerous duties, such as arrests and raids, two or more agents are assigned to work together.

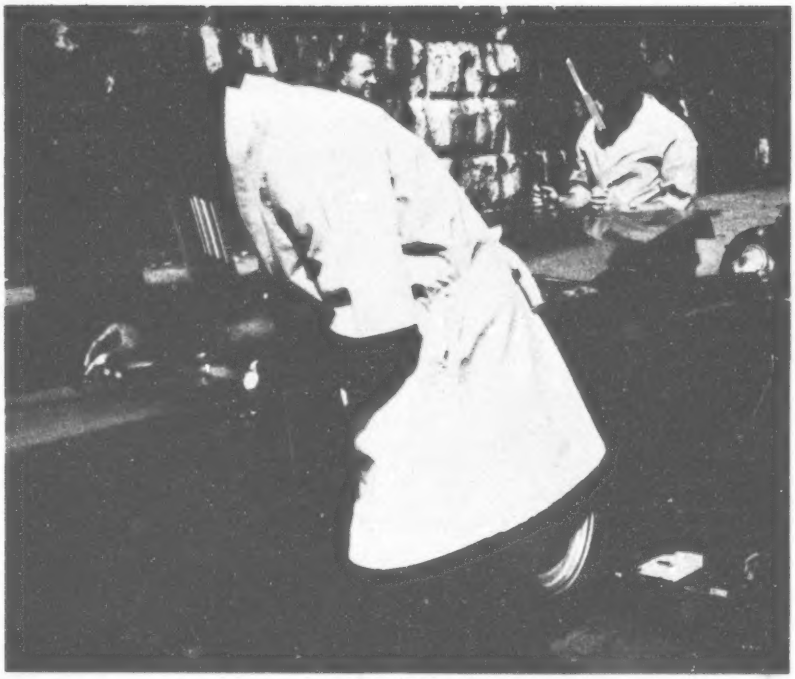
Places of Employment

About 8,600 persons were Special Agents in 1972. Although the vast majority were men, in May, 1972, the FBI began accepting applications from women. There are now a small number of women assigned as Special Agents.

Most agents were assigned to the FBI's 59 field offices located throughout the Nation and in Puerto Rico. They worked in cities where field office headquarters are located or in resident agencies (sub-offices) established under field office supervision to provide prompt and economic handling of investigative matters arising throughout the field office territory. Some agents are assigned to the Bureau headquarters staff in Washington, D.C., which supervises all FBI activities.

Training, Other Qualifications, and Advancement

To be eligible for appointment as



FBI Special agents inspect car for fingerprints.

an FBI Special Agent, an applicant usually must have graduated from a State-accredited resident law school or a 4-year resident college with a major in accounting. The law school training must have been preceded by at least 2 years of resident undergraduate college work. Accounting graduates must have at least 1 year of experience in accounting, auditing, or a combination of both. In addition, the position is available to persons who have a 4-year resident college degree with a physical science major or fluency in a foreign language for which the FBI has a current need, or 3 years of professional, executive, complex investigative, or other specialized experience.

Applicants for the position of FBI Special Agent must be citizens of the United States, at least 23 and not more than 40 years old, and willing to serve anywhere in the United States or Puerto Rico. They must be at least 5 feet 7 inches tall and capable of strenuous physical exertion; they must have excellent hearing and vision, normal color perception, and no physical defects which would prevent their using firearms or participating in dangerous assignments. Each applicant must pass a rigid physical examination, as well as written and oral examinations testing his knowledge of law or accounting and his aptitude for meeting the public and conducting investigations. All of the tests except the physical examinations are given by the FBI at its facilities. Exhaustive background and character investigations are made of all applicants. Appointments are made on a probationary basis and become permanent after 1 year of satisfactory service.

Each newly appointed Special Agent is given approximately 14 weeks of training at the FBI Academy at the U.S. Marine Corps Base in Quantico, Virginia before assignment to a field office. During this period, agents receive intensive training in defensive tactics and firearms. In addition, they are thoroughly schooled in Federal criminal law and procedures, FBI rules and regulations, fingerprinting, and investigative work. After assignment to a field office, the new agent usually works closely with an experienced agent for about 2 weeks before handling any assignments independently.

All administrative and supervisory jobs are filled from within the ranks by selecting those FBI Special Agents who have demonstrated the ability to assume more responsible positions.

Employment Outlook

The FBI has experienced a substantial expansion in its jurisdiction over the years. Although it is impossible to forecast Special Agent personnel requirements, employment may be expected to increase with growing FBI responsibilities.

The FBI provides a career service and its rate of personnel turnover is traditionally low. Nevertheless, the FBI is always interested in applications from qualified persons who would like to be considered for the position of Special Agent.

Earnings and Working Conditions

The entrance salary for FBI Special Agents was $12,776 in January 1973. Special Agents are not appointed under Federal Civil Service regulations, but, like other Federal employees, they receive periodic within-grade salary raises if their work performance is satisfactory; they can advance in grade as they gain experience.

Special Agents are subject to call 24 hours a day and must be avail-

able for assignment at all times and places. They frequently work longer than the customary 40-hour week and, under certain specified conditions, receive over-time pay up to $3,000 a year. They are granted paid vacations, sick leave, and annuities on retirement.

Sources of Additional Information

The Federal Bureau of Investigation, U.S. Department of Justice, Washington, D.C. 20535.

FIREFIGHTERS

(D.O.T. 373.118 through .884)

Nature of the Work

Every year fires destroy thousands of lives and property worth millions of dollars. Firefighters help protect the public against this danger. This statement gives information about firefighters who work full time for city fire departments. It does not cover part-time volunteers, private firefighters, or those employed by the Federal and State governments.

During duty hours firefighters must be prepared to rush to a fire and handle any emergency that occurs. Because firefighting is dangerous and complicated it requires teamwork and good organization. At every fire, firefighters perform specific duties assigned by their commanding officer: They may connect hose lines to hydrants, operate a pressure pump, or position ladders. Because their duties may change several times while the company is in action they must be skilled in many different firefighting activities. In addition, they help people to safety and administer first aid.

Fire departments also are responsible for fire prevention. Many departments provide specially trained personnel to inspect public buildings for conditions that might cause a fire. They may check the number and working condition of fire escapes and fire doors, the storage of flammable materials, and other possible hazards. In addition, firefighters educate the public about fire prevention and safety measures. They frequently speak on this subject before school assemblies and civic groups; and, in some communities, they inspect private homes for fire hazards.

Between alarms, firefighters spend much time improving their skills and doing maintenance work. They also have practice drills, clean and lubricate equipment, and stretch hoses to dry.

Places of Employment

About 200,000 men worked as firefighters in city fire departments in 1972. Some very large cities have several thousand firemen; some towns have fewer than 25. In addition, about 1,000 women worked as dispatchers in city fire stations.

Training, Other Qualifications, and Advancement

Applicants for firefighting jobs must pass a written intelligence test, a medical examination, and tests of strength, physical stamina, and agili-

ty, as specified by local civil service regulations. In most communities, these examinations are open to men who are at least 21 years of age, meet certain height and weight requirements, and have a high school education. Those who receive the highest scores on the examinations have the best chances for appointment. Extra credit usually is given for military service, and experience gained as a volunteer fireman or through training in the Armed Forces also may improve an applicant's chances for appointment.

As a rule, beginners in large fire departments are trained for several weeks at the city's fire school. Through classroom instruction and practice drills, the recruits study firefighting techniques, fire prevention, local building codes, and first aid; also, they learn how to use axes, chemical extinguishers, ladders, and other equipment. After completing this training, they are assigned to local fire companies.

Experienced firefighters often continue study to improve their job performance and prepare for promotional examinations. Fire departments frequently conduct training programs, and many colleges and universities offer courses such as fire engineering and fire science that are helpful to firefighters.

Among the personal qualities firefighters need are mental alertness, courage, mechanical aptitude, endurance, and a sense of public service. Initiative and good judgment are extremely important because firefighters often must make quick decisions in emergency situations. Because members of a crew eat, sleep, and work closely together under conditions of stress and danger, they should be dependable and able to get along well with others in a group. Leadership qualities are assets for officers who must establish and maintain a high degree of discipline and efficiency as well as plan and direct the activities of the firefighters in their companies.

Opportunities for promotion are good in most fire departments. As firefighters gain experience, they may advance to higher ratings. After 3 to 5 years of service they may become eligible for promotion to the grade of lieutenant. The line of further promotion usually is to captain, then battalion chief, assistant chief, deputy chief, and finally to chief. Chances for advancement generally depend upon each candidate's position on the promotion list, as determined by his score on a written examination, his supervisor's rating, and his seniority.

Employment Outlook

The employment of firefighters is expected to increase rapidly through the mid-1980's to meet the need for fire protection in growing urban communities. Many jobs will become available in new and expanding departments; thousands of additional openings will occur as firefighters die, retire, or leave their jobs for other reasons.

Employment of firefighters should continue to grow as new fire departments form and others enlarge their fire prevention sections. Many jobs also will be created as smaller communities replace volunteer fire companies with official departments. In addition, more firemen will be required as city fire departments continue to shorten the hours that their men work.

The number of young men who qualify for firefighter jobs in large cities usually is greater than the number of job openings, even though the written examination and physical requirements eliminate many applicants. Therefore, competition among candidates is apt to remain keen.

Earnings and Working Conditions

In 1972, most firefighters in cities with populations of 100,000 or more who had 1 or 2 years' experience earned between $9,000 and $10,700 a year.

Salaries varied by city size and region of the country. For example, firefighters earned from $8,100 to $9,700 in small cities, $8,800 to $10,500 in cities of 500,000 to 1 million in population, and $10,400 to $12,250 in those larger than 1 million. Earnings for firefighters were lowest in the South and highest in the West. Average earnings of all firefighters were about one and one-half times as much as the average of all nonsupervisory workers in private industry, except farming.

Fire chiefs in cities of 100,000 or more averaged $23,700 a year in 1972. Those who headed fire departments in cities with populations of more than 1 million earned $32,000.

Practically all fire departments furnish allowances to pay for protective clothing (helmets, boots, and rubber coats) and many also provide dress uniforms.

In some cities, firefighters are on duty for 24-hours, then off for 24 hours, and receive an extra day off at intervals. In other cities, they work a day shift of 10 hours or a night shift of 14; shifts are rotated at frequent intervals. The average workweek for firefighters is 51 hours, but duty hours usually include some time when they are free to read, study, or pursue other personal interests. In addition to scheduled hours firefighters often must work extra hours when they are bringing a fire under control. When overtime is worked most fire departments give compensatory time off or extra pay.

The job of a firefighter involves risk of death or injury from sudden cave-ins of floors or toppling walls and danger from exposure to flames

and smoke. Firemen also may come in contact with poisonous, flammable, and explosive gases and chemicals. In addition, they frequently work in bad weather.

Firefighters generally are covered by liberal pension plans that often provide retirement at half pay at age 50 after 25 years of service or at any age if disabled in the line of duty. Firefighters also receive paid vacations. Provisions for sick leave usually are liberal. Health and surgical benefit plans are offered in many fire departments and compensation is provided for firefighters injured in the line of duty. Most fire departments provide paid holidays—ranging to 11 or more a year—or compensatory time off for working on holidays.

Nearly three-fourths of all firefighters are members of the International Association of Firefighters (AFL-CIO).

Sources of Additional Information

Information on obtaining a job as a firefighter is available from local civil service commission offices or fire departments.

Information about a career as a firefighter or specific job duties may be obtained from:

International Association of Fire Fighters, 905 16th St. NW., Washington, D.C. 20006.

International Association of Fire Chiefs, 1725 K St. NW., Washington, D.C. 20006.

Additional information on the salaries and hours of work of firemen in various cities is published annually by the International City Management Association in its *Municipal Yearbook*, which is available in many libraries.

GUARDS AND WATCHMEN

(D.O.T.372.868)

Nature of the Work

Guards and watchmen patrol and inspect property to protect it against fire, theft, vandalism, and illegal entry. The specific duties of these workers, however, vary by size, type, and location of employer.

In office buildings, banks, hospitals, and department stores, guards and watchmen protect records, merchandise, money, and equipment. Department store guards often work with plainclothesmen watching for theft by store employees.

At ports and railroads, guards and watchmen protect merchandise in shipment as well as property and equipment. They make sure that nothing is stolen while being loaded or unloaded, and guard against fires, prowlers, and trouble among work crews. Sometimes they direct traffic.

Guards who work in public buildings, such as museums or art galleries, protect paintings or exhibits from fire, theft, or damage. They also answer routine questions from visitors and sometimes guide traffic.

In large factories, aircraft plants, and defense installations where valuable information must be protected, some guards check the credentials of persons and vehicles entering and leaving the premises. University, park, or recreation guards perform similar duties and also may issue parking permits and direct traffic.

At social affairs, sports events, conventions, and other public gatherings, guards maintain order, give information, and watch for suspicious persons.

In a large organization, guards may serve under a security officer who is in charge of the guard force; in a small organization a single watchman may be responsible for security. Patrolling is usually done on foot; but if the property is large, guards or watchmen may make their rounds by car or motor scooter.

As they make their rounds, guards and watchmen check all doors and windows, see that no unauthorized persons remain after working hours, and insure that fire extinguishers, alarms, sprinkler systems, furnaces, and various electrical and plumbing systems are working properly. Guards sometimes set thermostats or turn on machines for janitorial workers.

Guards and watchmen usually are uniformed and often carry a nightstick or gun. They also may carry a flashlight, whistle, two-way radio, and a watch clock—a device that indicates the time at which they reach various check-points.

Places of Employment

In 1972, about 250,000 persons—90 percent of them men—worked as guards and watchmen.

Most guards and watchmen work

in office buildings, defense installations and other government buildings, hospitals, nursing homes, hotels, banks, and schools. Large numbers also work in manufacturing industries including automobiles, aerospace, steel, and rubber.

Although guard and watchman jobs are found throughout the country, most are located in highly industrialized areas.

Training, Other Qualifications, and Advancement

Although there are no specific educational requirements, most employers prefer guards and watchmen who are high school graduates. Applicants with less than a high school education usually are tested for their reading and writing abilities and their competence in following written and oral instructions. Employers also seek people who have had experience in the military police or in State and local police departments.

Candidates for guard and watchman jobs in the Federal Government must be veterans, have some experience as guards, and pass a written examination. For most Federal guard positions, applicants must qualify in the use of firearms. A driver's permit is required for some jobs.

Many employers give newly hired guards pre-job instruction and several weeks of on-the-job training. Guards may be taught the use of firearms, the administration of first aid, how to handle various emergencies, and ways to spot and deal with security problems.

Applicants are expected to have good character references; no police record; good health—especially in hearing and vision; and good personal habits such as neatness and dependability. They also should be mentally alert, emotionally stable, and physically fit to cope with emergencies. Some employers require guards to meet height and weight specifications or to be within a certain age range. For example, insurance companies and accounting firms may hire older guards; while banks and jewelers, often threatened by robberies, may prefer younger applicants better able to handle intruders.

Although guards and watchmen in small companies receive periodic salary increases, advancement is likely to be limited. However, most large organizations use a military-type ranking of guards—from patrolman, through intermediate ranks, to captain—that offers advancement in position and salary. Guards with some college education may advance to jobs that involve administrative duties or the prevention of espionage and sabotage.

Employment Outlook

Employment of guards and watchmen is expected to grow moderately through the mid-1980's as the number of plants, stores, and other organizations where they work expands. The increase in crime, vandalism, and social unrest also should heighten the need for these workers.

In addition to new jobs created by employment growth, thousands of openings will occur each year as guards retire, die, or leave their jobs for other reasons. Replacement needs in this occupation are relatively high because guards and watchmen are somewhat older, on the average, than workers in most occupations.

Earnings and Working Conditions

Guards and watchmen in private industry averaged $100 a week in 1972, according to a Bureau of Labor Statistics survey of urban areas. Those working in the North earned more than the average while guards employed in the South earned somewhat less. Guards and watchmen earn about four-fifths as much as the average for all nonsupervisory workers in private industry, except farming.

Depending on their experience, newly hired guards in the Federal Government earned between $112 and $126 a week. Top supervisory guards in the Federal Government may be paid up to $225 a week. These workers usually receive over-time pay as well as a wage differential for the second and third shifts. Guards and watchmen generally have paid vacations, sick leave, and insurance and pension plans.

About two-thirds of all guards and watchmen work at night; the usual shift lasts 8 hours. Some employers have three shifts where guards rotate to divide daytime, weekend, and holiday work equally. Guards and watchmen usually eat on the job instead of taking a regular lunch break.

Because guards often work alone, they have no one to call if an accident or injury occurs. To reduce this hazard, some large firms use a reporting service that enables guards and watchmen to be in constant contact with a central station outside the plant. If they fail to transmit an expected signal, the central station investigates.

Sources of Additional Information

Further information about work opportunities for guards and watchmen is available from local employers and the nearest State employment service office.

POLICE OFFICERS

(D.O.T. 375.118 through .868 and 377.868)

Nature of the Work

The security of our Nation's cities and towns depends greatly on the work of local policemen whose jobs range from controlling traffic to preventing and investigating crimes. Whether on or off duty, these officers are expected to exercise their authority whenever necessary.

The policeman who works in a small community has many duties. In the course of a day's work, he may direct traffic at the scene of a fire, investigate a housebreaking, and give first aid to an accident victim. In a large police department, by contrast, officers usually are assigned to a specific type of duty. Most policemen are detailed either to patrol or traffic duty; smaller numbers are assigned to special work, such as accident prevention or operation of communications systems. Others work as detectives (plain-clothesmen) assigned to criminal investigation; still others, as experts in chemical and microscopic analysis, firearms identification, and handwriting and fingerprint identification. In very large cities, a few officers may work with special units such as mounted and motorcycle police, harbor patrols, helicopter patrols, canine corps, mobile rescue teams and youth aid services.

Some city police departments have women on their forces. Although some are assigned to regular patrol duty, most work with juvenile delinquents, or search, question, book, and fingerprint women prisoners. They may also work with detective squads, where they normally handle crimes involving women.

Most newly recruited policemen begin on patrol duty. Patrolmen may be assigned to such varied areas as congested business districts, outlying residential areas, or other sections of a community. They may cover their beats alone or with other patrolmen, and they may ride in a police vehicle or walk on "foot" patrol. In any case, they become thoroughly familiar with conditions throughout their area and, while on patrol, remain alert for anything unusual. They note suspicious circumstances, such as open windows or lights in vacant buildings, as well as hazards to public safety such as burned-out street lights or fallen trees. Patrolmen also watch for stolen automobiles and enforce traffic regulations. At regular intervals, they report to police headquarters through call boxes, by radio, or by walkie-talkie. They must also prepare reports about their activities and may be called on to testify in court when cases result in legal action.

Places of Employment

About 370,000 full-time officers worked for local police departments in 1972. Although most were men, an increasing number of women are now being employed.

Some cities have very large police forces. For example, New York has over 30,000 police officers and Chicago over 13,000. Hundreds of small communities employ fewer than 25 policemen each. Policewomen work mainly in large cities.

Training, Other Qualifications, and Advancement

Local civil service regulations govern the appointment of police officers in practically all large cities and in many small ones. Candidates must be U.S. citizens, usually at least 21 years of age, and be able to meet certain height and weight standards. Eligibility for appointment depends

on performance on competitive examinations, as well as on education and experience. The physical examinations often include tests of strength and agility.

Because personal characteristics such as honesty, good judgment, and a sense of responsibility are especially important in police work, candidates are interviewed by a senior officer at police headquarters, and their character traits and background are investigated. In some police departments, candidates also may be interviewed by a psychiatrist or a psychologist, or given a personality test. Although police officers work independently, they must perform their duties in line with laws and departmental rules. They should enjoy working with people, and should want to serve the public.

In large police departments, where most jobs are found, applicants usually must have a high school education. A few cities require some college training and some hire law enforcement students as police interns. A few police departments accept men who have less than a high school education as recruits, particularly if they have worked in a field related to law enforcement.

More and more police departments encourage applicants to take post-high school training in sociology and psychology. As a result, more than 500 junior colleges, colleges, and universities now offer programs in law enforcement. Other courses helpful in preparing for a police career include English, American history, civics and government, business law, and physics. Physical education and sports are especially helpful in developing the stamina and agility needed for police work.

Young persons who have completed high school can enter police work in some large cities as police cadets, or trainees, while still in their teens. As paid civilian employees of the police department, they attend classes to learn police skills and do clerical work. They may be appointed to the regular force at age 21 if they pass all necessary qualifications.

Before their first assignments, policemen usually go through a period of training. In small communities, recruits learn by working for a short time with experienced officers. Training provided in large city police departments is more formal and may last several weeks or a few months. This training includes classroom instruction in constitutional law and civil rights; in State laws and local ordinances; and in accident investigation, patrol, and traffic control. Recruits learn how to use a gun, defend themselves from attack, administer first aid, and deal with emergencies.

Policemen and policewomen usually become eligible for promotion after a specified length of service. In a large department, promotion may allow an officer to specialize in one type of police work such as laboratory work, traffic control, communications, or work with juveniles. Promotions to the rank of sergeant, lieutenant, and captain usually are made according to each candidate's position on a promotion list, as determined by his performance on written examinations and his work as a police officer.

Many types of training help police officers improve their performance on the job and prepare for advancement. Through training given at police department academies and colleges, officers keep abreast of crowd-control techniques, civil defense, legal developments that affect policemen, and advances in law enforcement equipment. Many police departments encourage officers to work toward college degrees, and some pay all or part of the tuition.

Employment Outlook

Employment opportunities for police officers are expected to be favorable for qualified applicants through the mid-1980's. Police employment should rise rapidly as population and economic growth create a need for more officers to protect life and property, regulate traffic, and provide other police services. Many openings also will occur as policemen retire or leave their jobs for other reasons.

The use of modern police methods has increased the need for officers with specialized skills. In an increasing number of departments, for example, electronic data processing is used to compile administrative, criminal, and identification records, and to operate emergency communications systems. Many departments also need officers with specialized training to apply engineering techniques to traffic control or social work techniques to crime prevention. At the same time, the use of automatic signal lights has somewhat reduced the number of policemen needed for directing traffic.

Earnings and Working Conditions

In 1972, starting salaries of police officers in cities with populations of 100,000 or more averaged $9,500 a year. Most officers receive regular salary increases during the first few years of employment until they reach a set maximum. Maximum earnings averaged just over $11,000 a year in 1972. In general, police officers are paid about one and one-half times as much as nonsupervisory workers in private industry, except farming.

Although sergeants, lieutenants, and captains receive higher basic salaries than patrolmen, the highest earnings are paid to police chiefs or commissioners. These top law en-

forcement officials may earn as much as $40,000 a year in the largest cities.

Police departments usually provide officers with special allowances for uniforms and furnish revolvers, night sticks, handcuffs, and other required equipment.

The scheduled workweek for police officers usually is 40 hours. Because police protection must be provided around the clock, in all but the smallest communities some officers are on duty over weekends, on holidays, and at night. Policemen are subject to call any time their services are needed and may work overtime in emergencies. In some departments, overtime is paid at straight time or time and a half; in others, officers may be given an equal amount of time off on another day of the week.

Police officers generally are covered by liberal pension plans, enabling many to retire at half pay by the time they reach age 55. In addition, paid vacations, sick leave, and medical and life insurance plans frequently are provided.

Policemen may have to work outdoors for long periods in all kinds of weather. The injury rate is higher than in many occupations and reflects the risks officers take in pursuing speeding motorists, capturing lawbreakers, and dealing with public disorder.

Sources of Additional Information

Information about entrance requirements may be obtained from local civil service commissions or police departments.

Additional information describing careers as policemen or policewomen may be obtained from:

Fraternal Order of Police, National Headquarters, 3094 Bertha St., Flint, Mich. 48504.

STATE POLICE OFFICERS

(D.O.T. 375.118, .138, .168, .228, .268, and .388)

Nature of the Work

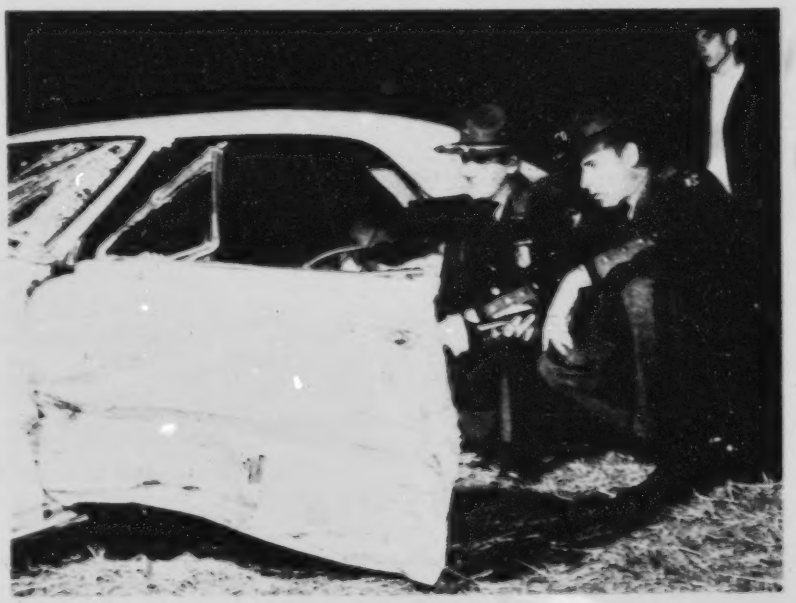
The laws and regulations that govern the use of our Nation's roadways are designed to insure the safety of all citizens. State policemen (sometimes called State highway patrolmen or troopers) patrol our highways and enforce these laws.

State police officers issue traffic tickets to motorists who violate the law. At the scene of an accident, they direct traffic, give first aid, call for emergency equipment including ambulances, and write reports to be used in determining the cause of the accident.

In addition, State police officers provide services to motorists on the highways. For example, they radio for road service for drivers in mechanical trouble, direct tourists to their destination, or give information about lodging, restaurants, and tourist attractions.

State police officers also provide traffic assistance and control during road repairs, fires, and other emergencies, as well as for special occurrences such as parades and sports events. They sometimes check the weight of commercial vehicles, conduct driver examinations, and give information on highway safety to the public.

State policemen may investigate crimes, such as thefts, murders, and narcotics violations, particularly in areas that do not have a police force. They sometimes help city or county police investigate criminals, catch lawbreakers, and control civil disturbances. State highway patrols, however, normally are restricted to responsibilities involving vehicle and traffic matters.



State police investigate serious accident.

Some police officers specialize in fingerprint classification, chemical or microscopic analysis of criminal evidence, instructing trainees in State police schools, and piloting police aircraft. Others work with special State police units such as the mounted police, canine corps, and marine patrols.

State police officers also write reports and maintain police records. Some officers, including division or bureau chiefs responsible for training or investigation and those who command police operations in an assigned area, have administrative duties.

Places of Employment

About 44,000 State police officers were employed in 1972. Although almost all were men, positions for women are expected to increase in the future.

The size of State police forces varies considerably. The largest force (in California) has over 5,000 officers; the smallest (in North Dakota) has fewer than 100. One state (Hawaii) does not maintain a police force.

Training, Other Qualifications, and Advancement

State civil service regulations govern the appointment of State police officers. All candidates must be citizens of the United States. Other entry requirements vary by State, but most require applicants to have a high school education or an equivalent combination of education and experience and be at least 21 years old.

Officers must pass a competitive examination and meet physical and personal qualifications. Physical requirements include standards of height, weight, and eyesight. Tests of strength and agility often are required. Because honesty and a sense of responsibility are important in police work, an applicant's character and background are investigated.

Although State police officers work independently, they must perform their duties in line with department rules. They should want to serve the public and be willing to work outdoors in all types of weather.

In all States, recruits enter a formal training program for several months. They receive classroom instruction in State laws and jurisdictions, and they study procedures for accident investigation, patrol, and traffic control. Recruits learn to use guns, defend themselves from attack, handle an automobile at high speeds, and give first aid. After gaining experience, some officers take advanced training in police science, administration, law enforcement, or criminology. Classes are held at junior colleges, colleges and universities, or special police institutions such as the National Academy of the Federal Bureau of Investigation.

High school and college courses in English, reading, government, psychology, sociology, and physics help in preparing for a police career. Physical education and sports are useful for developing stamina and agility. Completion of a driver education course and training received in military police schools also are assets.

Police officer recruits serve a probationary period ranging from six months to three years. After a specified length of time, officers become eligible for promotion. Most States have merit promotion systems that require officers to pass a competitive examination to qualify for the next highest rank. Although the organization of police forces varies by State, the typical avenue of advancement is from private to corporal, to sergeant, to first sergeant, to lieutenant, and then captain. Police officers who show administrative ability may be promoted to higher level jobs such as commissioner or director.

In some States, high school graduates may enter State police work as cadets. These paid civilian employees of the police organization attend classes to learn various aspects of police work and are assigned nonenforcement duties. Cadets who qualify may be appointed to the State police force at age 21.

Employment Outlook

State police employment is expected to rise very rapidly through the mid-1980's. Although most jobs will result from growth in employment, some openings will be to replace officers who retire, die, or leave the occupation for other reasons.

Although some State police will be needed in criminal investigation and other nonhighway functions, the greatest demand will be for officers to work in highway patrol. This is the result of a growing and more mobile population. Along with an increasing number of motor vehicles, the nature of highway systems is rapidly changing. Limited access highways need heavier police patrol to control high speeds, prevent accidents, and help stranded motorists. The newer dual highways also require more patrolmen, because officers can handle only one side of these roads.

Because law enforcement work is becoming more complex, specialists will be needed in crime laboratories and electronic data processing centers to develop administrative and criminal information systems.

Earnings and Working Conditions

In 1972, beginning salaries for State policemen ranged from about

$500 to nearly $800 a month. The most common entry rates ranged from $600 to $700 a month. Although starting salaries are normally higher in the West and lower in the South, State police officers on the average earn about one and one-half times as much as nonsupervisory workers in private industry, except farming.

State policemen generally receive regular increases, based on experience and performance, until a specified maximum is reached. The 1972 maximums ranged from $700 to over $1,200 a month; the most common maximum rates ranged between $800 and $900 a month. Earnings increase with promotions to higher ranks. The most common maximum salaries for State police sergeants were between $900 and $1,000. Lieutenants earn more, often between $1,100 and $1,200 a month.

State police agencies usually provide officers with uniforms, firearms, and other necessary equipment, or give special allowances for their purchase.

In many States, the scheduled workweek for police officers is 40 hours. Although the workweek is longer in some States, hours over 40 are being reduced. Since police protection must be provided around the clock, some officers are on duty over weekends, on holidays, and at night. Police officers also are subject to emergency calls at any time.

State policemen usually are covered by liberal pension plans. Paid vacations, sick leave, and medical and life insurance plans frequently are provided.

The work of State police officers is sometimes dangerous. They always run the risk of an automobile accident while pursuing speeding motorists or fleeing criminals. Officers also face the risk of injury while apprehending criminals or controlling disorders.

Sources of Additional Information

Information about specific entrance requirements may be obtained from State civil service commissions or State police headquarters, usually located in each State Capitol.

HEALTH AND REGULATORY INSPECTORS (GOVERNMENT)

(D.O.T 168.168, 168.268, and 168.287)

Nature of the Work

Protecting the public from health and safety hazards, prohibiting unfair trade and employment practices, and raising revenue are included in the wide range of responsibilities of government. Health and regulatory inspectors insure observance of the laws and regulations that govern these responsibilities.

The duties, titles, and responsibilities of Federal, State, and local health and regulatory inspectors vary widely. Some types of inspectors work only for the Federal Government while others also are employed by State and local governments. Health and regulatory inspectors are two of the principal types of government inspectors. For discussion of a third, see the statement on Construction Inspectors (Government) elsewhere in the *Handbook*. Many other workers employed as accountants, agricultural cooperative extension service workers, and other agricultural professionals, manufacturing inspectors, safety professionals, and sanitarians also have inspection duties.

Health inspectors work with engineers, chemists, microbiologists, and health workers to insure compliance with public health and safety regulations governing food, drugs, and various other consumer products. They also administer regulations that govern the quarantine of persons and products entering the United States from foreign countries. The major types of health inspectors are: food and drug, meat and poultry, egg products, foreign quarantine, and agricultural quarantine inspectors.

Federal, State, and local government laws declare that marketed foods must be wholesome and produced under sanitary conditions; that drugs, cosmetics, therapeutic devices, and other products must be safe and effective for their intended uses; and that such products must be honestly packaged and labeled. *Food and drug inspectors* make certain that the Nation's businesses comply with these laws.

Most food and drug inspectors specialize in one area of inspection such as food, feeds and pesticides, weights and measures, or drugs and cosmetics. Some, especially those who work for the Federal government, may be proficient in several of these areas. Working individually or in teams under the direction of a senior or supervisory inspector they travel throughout a geographical area to check, periodically, firms that produce, handle, store, and market food, drugs, and cosmetics. They look for evidence of inaccurate product labeling, decomposition, chemical or bacteriological contamination, and other factors that could result in a product becoming detrimental to consumer health. They assemble evidence of violations using portable scales, cameras, ultraviolet lights, container sampling devices, thermometers, chemical testing kits, and other types of equipment.

Product samples collected as part

Food and drug inspector checks food for leakage or signs of contamination.

of their examinations are sent to laboratories for analysis. After completing their inspection, they discuss their observations with the management of the plant and point out any areas where corrective measures are needed. They prepare written reports of their findings, and, when necessary, compile evidence that may be used in court if legal actions must be taken to effect compliance with the law.

Federal and State laws empower *meat and poultry inspectors* to inspect meat, poultry, and their by-products to insure that they are wholesome and safe for public consumption. Working as part of a constant on-site team under the general supervision of a veterinarian, they inspect meat and poultry, slaughtering, processing, and packaging operations. Those carcasses or parts found to be safe and wholesome are conspicuously stamped to that effect. They condemn as unfit for human consumption any animals, carcasses, or processed meat and poultry which they find displaying evidence of disease, contamination, or poor processing. Meat and poultry inspectors also collect samples for laboratory analysis and examine all non-meat ingredients used in processing. They check to see that products are labeled correctly and that proper sanitation is maintained in slaughtering and processing operations.

Egg products inspectors are entrusted by law with the responsibility of insuring that egg products are sanitarily processed and packaged free of contamination or spoilage. Working at egg processing plants, they supervise the washing and examination of shell eggs to insure that broken eggs are removed and destroyed or denatured. They supervise the processing, cooling, pasteurization, storage, and handling of all dried, liquid, or frozen egg products. Periodically, they select samples of processed egg products for laboratory analysis to insure that they have not spoiled or become contaminated due to improper storage or handling. Each day before production begins, they also inspect the plant and its equipment to insure that it has been properly cleaned and that the standards of sanitation are maintained.

The responsibility of *foreign quarantine inspectors* is to prevent the importation of communicable diseases. They inspect the passengers, crew, and cargo of aircraft, and maritime vessels arriving at airports and seaports, to determine their medical acceptability for entrance into the United States. Working closely with customs, immigration, and agricultural quarantine inspectors, they examine travelers for symptoms of diseases, such as smallpox. Any individuals that they believe to be ill they detain for examination by a physician. Foreign quarantine inspectors also enforce regulations pertaining to the admission of animals into the United States since many diseases common to various species of animals are communicable to man. In addition, they prepare and maintain documents, certificates, and reports on persons or animals detained under suspicion of having contracted a communicable disease.

Agricultural quarantine inspectors protect American agricultural products from the introduction and spread of foreign plant pests and animal diseases. To safeguard the health of crops, forests, and gardens, they inspect ships, aircraft, railroad cars, and motor vehicles seeking to enter the United States for the presence of restricted or prohibited plant or animal materials. They often work with customs inspectors to inspect mail and passenger baggage. They examine fruits and

vegetables, nursery stock, plants, seeds, and soil passing through ports of entry for the presence of foreign insects, mites, snails, or plant diseases. Plants and plant products restricted, suspected to be pest infested, or with which "hitchhiking" pests are associated are ordered destroyed or fumigated. Agricultural quarantine inspectors also examine meat and animal products and by-products entering the United States from foreign countries to determine that they are properly processed and do not carry dangerous foreign animal diseases. At the request of American exporters, they may also inspect and certify domestically grown plants and plant and animal products for compliance with the import requirements of foreign countries.

Regulatory inspectors insure compliance with various laws and regulations that protect the public welfare Important types of regulatory inspectors are: immigration, customs, aviation safety, mine, wage-hour compliance, and alcohol, tobacco, and firearms inspectors.

Immigration inspectors interview and examine people seeking admission, readmission, or the privileges of passing through or residing in the United States. They inspect the passports of aliens and U.S. citizens to determine whether they are legally eligible to enter the United States and to verify their citizenship, status, and identity. Working closely with inspectors in foreign quarantine, agricultural quarantine, and customs, they examine the visas of aliens and inquire as to the reasons for their visit. If they question an individual's admissibility, he can be detained. Immigration inspectors also prepare reports, maintain records, and process applications and petitions by aliens for privileges such as immigrating to or temporarily living in the United States.

Customs inspectors enforce the laws governing U.S. imports and exports. Stationed at airports, seaports, and border crossing points they count, weigh, gauge, measure, and sample commercial cargoes entering and leaving the United States to determine the amount of tax that must be paid. They also inspect baggage and articles worn or carried by the passengers and crew of ships, aircraft, and motor vehicles to insure that all merchandise being brought through ports of entry is declared and the proper taxes paid.

Most often, customs inspectors participate in a traveler inspection program at points that have a large volume of travelers passing through. They screen travelers and baggage for violations of immigration laws, public health quarantine regulations, or transportation of prohibited meats, plants, or other materials. Customs inspectors who work at isolated border crossing points often perform the added duties of health, immigration and agricultural inspecting. They also participate in the enforcement of gold, narcotics, and trademark restrictions and work with Federal Bureau of Investigation (FBI) agents, treasury agents, and other law enforcement officers. When not conducting inspections, they write reports and keep records.

Aviation safety officers insure that Federal Aviation Administration (FAA) regulations that govern the quality and safety of aircraft equipment and personnel are maintained. Aviation safety officers may inspect aircraft manufacturing, maintenance, or operations procedures. They usually specialize in inspecting either commercial aircarriers or general aviation (privately owned and operated aircraft).

Working under the direction of a principal inspector, teams of from two to four manufacturing inspectors check the construction of every aircraft to assure that it conforms to its approved and certificated design. They spend about one half of their time visiting production facilities to make measurements and check the materials used during construction. Their results and observation are recorded and any changes or deviation they find from the certificated production model must receive approval or be corrected. They issue Airworthiness Certificates to acknowledge that an aircraft conforms to its design type. They also inspect manufacturers' production facilities and evaluate production methods and quality control systems in order to improve the quality and safety of aircraft being manufactured.

Aviation maintenance inspectors administer Federal regulations relating to the maintenance of commercial and private aircraft. They periodically examine and certify mechanics, mechanic training programs, and schools. They also inspect and certificate aircraft repair and maintenance facilities and major overhauls of aircraft or alterations. They determine if work was performed in accordance with the manufacturer's latest instructions and FAA approved methods, techniques, and practices.

Aviation operation inspectors inspect and certify aircraft pilots and flight crews, training programs and schools, pilot examiners, flight instructors, and instructional materials. Most operations inspectors examine and certify the pilots and crews of one or two models of planes. They also observe the semiannual proficiency flight checks given commercial pilots by their airlines or supervise the activities of approved FAA pilot examiners and inspect and certify general aviation ground and flight instructors, pilots, and other airmen. Operations inspectors

spend much of their time in the cockpit of aircraft observing the pilot and crews under actual flight conditions.

Mine inspectors work to enhance the health and safety of miners and to promote good mining practices. Federal mine inspectors are responsible for inspecting nearly 21,000 mining and quarrying operations.

To insure compliance with safety laws and regulations, mine inspectors visit mines and related facilities to obtain information on health and safety conditions. Before an inspection, they study the mine's permits, authorizations, and records to familiarize themselves with its operations. They note areas where violations were discovered in previous inspections and check on how these were corrected. At the work site, they look for evidence of flammable, combustible, or explosive gasses and dust and check roof supports, quantity of airflow, storage of explosives, haulage systems, and automatic mining equipment. They also inspect the surface equipment such as the electrical installations, elevators, and ventilation systems.

Mine inspectors discuss their findings with the management of the mine, prepare written reports that substantiate their findings and decisions, and issue notices of findings that describe violations and hazards that must be corrected. They also investigate and prepare reports on mine accidents and direct rescue and firefighting operations when fires or explosions occur.

Wage-hour compliance officers inspect the employer's time, payroll, and personnel records to insure compliance with the provisions of various Federal laws on minimum wages, overtime, pay, employment of minors, equal employment, and wage garnishment. They often interview employees to verify the employer's records and to check for any complaints. As recognized authorities on wage and hour standards, compliance officers often are consulted for advice by members of management and labor union officials.

Alcohol, tobacco, and firearms inspectors insure that the liquor, tobacco, and firearms industries comply with the provisions of revenue laws and other regulations on operating procedures, unfair competition, and trade practices. They spend most of their time inspecting distilleries, wineries, breweries; cigar and cigarette manufacturing plants; wholesale liquor dealers and importers; firearms and explosives manufacturers, dealers, and users; and other regulated facilities. They periodically audit these establishments to determine that appropriate taxes are correctly determined and paid. Alcohol, tobacco, and firearms inspectors also safeguard against unfair competition and trade practices.

Places of Employment

Nearly 25,000 people, 5 percent of them women, worked as health and regulatory inspectors in 1972. Of these, about 3 out of 5 are health inspectors, nearly half of whom are food and drug inspectors. The largest single employer of food and drug inspectors is the U.S. Food and Drug Administration but the majority work for State governments. Meat, poultry, and egg products inspectors who work in processing plants are employed mainly by the U.S. Department of Agriculture. Foreign quarantine and agricultural quarantine inspectors work either for the U.S. Public Health Service or the U.S. Department of Agriculture.

Regulatory inspectors work for various agencies within the Federal Government, mainly in regional and district offices distributed throughout the United States. For example, aviation safety officers work for the Federal Aviation Administration; wage-hour compliance officers, for the Department of Labor; mine inspectors, the Department of the Interior; and alcohol, tobacco, and firearms inspectors, the Treasury Department. Immigration, customs, and foreign and agricultural quarantine inspectors work at airports, seaports, border crossing points, and at foreign airports and seaports. They are employed by the Justice and the Treasury Departments.

Training, Advancement, and Other Qualifications

People who want to become health or regulatory inspectors should be able to accept responsibility and like detail work. They should be neat and personable and able to express themselves well orally and in writing. Curiosity is important since inspectors must keep abreast of technological advances and other developments in their fields. Persuasiveness also is an asset, since they frequently must convince people to comply with policies and procedures.

The U.S. Food and Drug Administration requires applicants for food and drug inspector jobs to have a bachelor of science degree which includes at least 18 semester hours of chemistry or biology. They also must achieve a satisfactory score on the Federal Service Entrance Examination (FSEE). Applicants who are accepted receive on-the-job training in the coverage of the Food, Drug, and Cosmetic Act, the extent of their authority, standards of sanitation and purity, inspections and sampling techniques, and the use of product testing equipment. They are given progressively more difficult field assignments under supervision until they are able to conduct independent inspections.

After 1 to 3 years of experience, food and drug inspectors may elect

to specialize in bacteriological sanitation, food, or drug inspection. Courses in these specialized areas are given by the U.S. Food and Drug Administration, usually in conjunction with colleges and universities. Inspectors often become experts in their chosen specialty fields and may be promoted to senior inspector and then supervisory inspector. Inspectors who display a high level of expertise in a specialty occasionally transfer to administrative positions in that area of operation. Food and drug inspectors who do not choose to specialize may advance to senior or resident inspector and, if qualified, to supervisory inspector.

A high school diploma and experience in meat or poultry slaughtering or processing generally are minimum requirements for becoming a meat and poultry inspector. A college education may be substituted for experience.

Working under the close supervision of experienced inspectors, trainees are taught plant inspection procedures that insure sanitary conditions and practices. They are instructed how to examine animals, carcasses, and processed meat and poultry for evidence of disease, contamination, or other undesirable conditions. When they are ready to assume their full inspectional duties, they usually begin as slaugher inspectors. After gaining experience they may advance to processing inspector, inspection supervisor, and officer-in-charge in a processing establishment.

A high school education and at least 3 years of experience in the quality control of fresh or processed food generally is the minimum requirement for employment as an egg products inspector. College education may be substituted for experience at the rate of one year of undergraduate study for 9 months of experience. Egg products inspectors receive classroom instruction in plant sanitation, facilities, proper handling of egg products, correct pasteurization procedures, sampling techniques, and record keeping. They get additional training on the job while working closely with an experienced inspector. Experienced inspectors can advance to supervisory positions.

Applicants for jobs as foreign quarantine inspectors should have at least 4 years of experience in communicable disease control or environmental sanitation; sanitary inspection at airports, seaports, or border points; performance of laboratory tests and analyses to determine the presence of germs or chemical composition; or recognizing illness, administering innoculations, and dispensing medicines. Courses above the high school level in the biological or physical sciences, public health, or sanitary engineering may be substituted for up to 3 years of experience. Applicants also must take a written examination.

Foreign quarantine inspectors begin as trainees and attend a training center where they learn regulations and inspection techniques. They also receive on-the-job training. Experienced inspectors can advance to supervisory positions.

The minimum educational requirement for agricultural quarantine inspectors is a bachelor's degree with a major in one of the biological sciences. Undergraduate work should include at least 20 semester hours in the life sciences. They receive additional on-the-job training and classroom instruction in these subjects during their first year of employment. After one year of successful service, inspectors are eligible for promotion and may eventually progress to specialists, supervisory, or administrative positions.

People can enter the immigration inspection field as an aide or trainee if they have a minimum of 3 years of administrative or responsible clerical work experience that demonstrates their ability to deal with people, learn and interpret facts, and obtain the cooperation of others in following procedures and regulations. College training may be substituted for up to 3 years of general experience at the rate of one scholastic year for 9 months of experience. Applicants must take the FSEE.

Immigration aides and inspector trainees receive a combination of formal instruction and on-the-job training. Trainees may be promoted after their first year of duty and may reach the journeyman level after an additional year. Further advancement to immigration examiner or supervisory and administrative positions depends upon individual merit.

The minimum requirement for beginning customs inspector jobs is 4 years of work experience in government, education, business, or the Armed Forces dealing with people and enforcing regulations or instructions. College education may be substituted for up to three years of experience at the rate of one year of college for 9 months of experience. Completion of all requirements for a law degree may be substituted for all experience. Applicants must take the FSEE, be in good physical condition, and be free of handicaps which might hinder them in the performance of their duties.

Customs inspectors begin as trainees and receive over a month of formal instruction in their duties. After a year of on-the-job training in which they work an experienced inspector, they receive regular assignments. Advancement is possible to supervisory inspector or to administrative positions.

At least 5 years of aviation related experience usually is required to get a job as an aviation safety officer.

Resident study in an appropriate field at an accredited college or university, however, may be substituted for up to 3 years of experience. Maintenance inspector applicants must have aircraft maintenance experience and hold an FAA mechanics certificate. Manufacturing inspector applicants must have experience in manufacturing of aircraft and aircraft components. Applicants for these positions may substitute a bachelor's degree in engineering or aviation for 3 years of experience. Operations inspector applicants must have pilot experience and a commercial pilot certificate.

Aviation safety officers are trained on-the-job and usually attend a 5-week indoctrination course in Oklahoma City. They periodically receive additional training to familiarize them with the operation, maintenance, or inspection of various models of aircraft or new aircraft manufacturing technology. Qualifed aviation safety officers may advance to supervisory inspector, principal inspector, or district office supervisor.

Applicants for beginning mine inspection jobs must be in good physical condition and possess at least 3 years of experience in mining or construction work where underground excavation is the principal activity. They also must take a general aptitude test and demonstrate their ability to drive a car. Persons who have at least 5 years of responsible experience in the mining industry are not required to take the aptitude test and may begin at higher salaries. A bachelor's degree may be substituted for 3 years of experience.

Trainees receive 10 weeks of classroom training in math, English, public speaking, inspection procedures, mining technology, surface structures, ventilation systems, roof supports, respirable dust, and fire protection. They also receive on-the-job training by teaming with an experienced inspector. Their inspection assignments become progressively more difficult until they are able to make a solo inspection.

Mine inspectors can advance to inspection supervisors, subdistrict and district managers, and specialists in dealing with specific types of mine hazards. Many become mine examiners or mine safety personnel in private industry.

Wage-hour compliance officers should have a bachelor's degree from an accredited college or university with at least 24 semester hours credit in any one or a combination of accounting, business administration, economics, government, industrial relations, journalism, law, political science, sociology, statistics, or closely related subjects. Three years of non-clerical work experience that provides knowledge of the basic principles of finance, economics, accounting, statistics, law, business, or public administration may be substituted for a bachelor's degree. After a few weeks on the job, compliance officer trainees attend a 4-week training program to acquaint them with wage-hour laws and standards. They accompany experienced compliance officers on field assignments and help them make inspections until they are ready to undertake independent assignments.

At least 3 years of working experience are generally the minimum requirement to become an alcohol and tobacco tax inspector. Education at an accredited college or university may be substituted for experience at the rate of one year of study for 9 months of experience or a bachelor's degree in lieu of experience. Applicants also must achieve a satisfactory score on the Federal Service Entrance Examination (FSEE).

People enter the field as trainee inspectors and receive a year of training that includes classroom instruction in the laws of regulations governing liquor, tobacco, and firearms industries; orientation in the inspection techniques used to determine compliance; and on-the-job training under the close supervision of an experienced inspector. The complexity of their assignments is gradually increased until they can work independently.

Employment Outlook

Employment of health and regulatory inspectors as a group is expected to increase very rapidly through the mid-1980's. The growth in employment of health inspectors is expected to be very rapid but regulatory inspectors are expected to have moderate growth. In addition to job opportunities stemming from growth, many inspectors will be needed each year to replace those who die, retire, or transfer to other occupations.

Health and regulatory inspection programs are expected to receive increased emphasis as the importance of existing programs is recognized and new mandatory inspection programs are created in areas where government involvement is new, particularly at the State and local level. Increased food consumption caused by population growth and growing public concern over potential health hazards should create additional jobs for food and drug, meat, and poultry, and egg products inspectors.

Aviation industry growth, increased international travel, and increases in the volume of U.S. imports and exports should continue to create new openings for aviation safety officers, foreign and agricultrual quarantine inspectors, immigration inspectors, and customs inspectors. Continued public concern over mine safety and equal employment rights should create

additional mine inspector and wage-hour compliance officer jobs.

Earnings and Working Conditions

With the exception of aviation safety officers, the Federal Government paid health and regulatory inspector trainees starting salaries of $7,694 a year in early 1973; or $9,520 if they had exceptional qualifications. Aviation safety officers received starting salaries of $11,614.

Salaries of experienced meat and poultry inspectors, egg products inspectors, foreign and agricultural quarantine inspectors, and customs and immigration inspectors ranged from $11,614 to $15,097 a year in 1973. Salaries of experienced alcohol, tobacco, and firearms inspectors ranged from $11,614 to $18,190. Experienced food and drug inspectors and wage-hour compliance officers received salaries ranging from $13,996 to $18,190. Mine inspector and aviation safety officers earned between $16,682 and $21,686.

Most health and regulatory inspectors live an active life, meeting many people and working in a variety of environments. They must often travel a great deal but are usually furnished with an automobile.

At times inspectors must work under unfavorable working conditions. For example, meat and poultry, egg products, and alcohol, tobacco, and firearms inspectors frequently come in contact with strong, unpleasant odors; aviation maintenance inspectors who spend much of their time in maintenance and repair shops, must tolerate a lot of noise, and mine inspectors spend a great deal of time in mines where they are exposed to the same hazards as miners. Many inspectors work long and often irregular hours.

Sources of Additional Information

For facts about public administration inspector careers in the Federal Government, contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

Information about career opportunities as inspectors in State and local governments is available from the State Civil Service Commissions, usually located in each State capital, or from local government offices.

CONSTRUCTION INSPECTORS (GOVERNMENT)

(D.O.T. 168.168 and 182.287)

Nature of the Work

Federal, State, and local government construction inspectors insure that recognized standards of safe construction and quality workmanship are observed in public and private construction. They inspect the construction, alteration, or repair of highways, streets, sewer and water systems, dams, bridges, buildings, and other structures to insure compliance with building codes and ordinances, zoning regulations, and contract specifications.

Construction inspectors visit worksites to inspect recently completed construction. On large projects, visits generally are required after each new stage of construction is completed. Members of large inspection staffs may be assigned to a single complex project. Inspectors prepare written reports and often keep a daily log of their work. Inspections are primarily visual in nature, although blueprints, tape measures, standard electrical metering devices and equipment frequently are used for testing the quality of concrete.

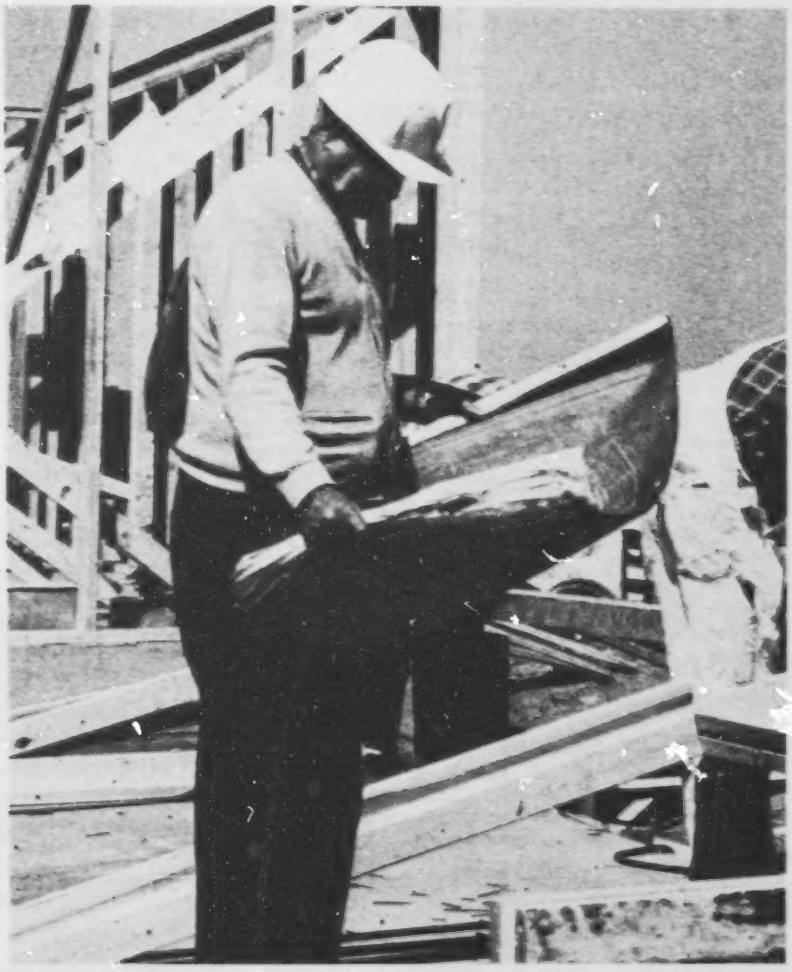
Construction inspectors notify the construction contractor, superintendent, or foreman when they discover a detail of a project that is not in compliance with the appropriate codes, ordinances, or contract specifications. If the deficiency is not corrected within a reasonable period of time, they have authority to issue a "stop-work" order.

Many inspectors also investigate reported incidents of "bootlegging," construction or alteration that is being carried on without proper permits. Persons found in violation of permit laws are directed to obtain permits and submit to inspection.

Construction inspectors must keep abreast of new building code developments, since they advise representatives of the construction industry and the general public on matters of code interpretation, construction practices, and new technical developments. Senior inspectors usually coordinate the inspection of large projects and handle the most complex inspection assignments.

In addition to their field inspection duties, supervisory construction inspectors assign and coordinate the work of other inspectors and review reports submitted to them. They may review plans and specifications of proposed construction for compliance with codes, interpret codes and ordinances, and prepare construction progress reports. Supervisory building inspectors are often asked to assist in drawing up or revising local building codes and ordinances.

Construction inspectors generally specialize in one particular type of construction work. Broadly categorized, these are building, electrical, mechanical, and public works.



A construction inspector checks a blueprint for compliance with the building code.

Building inspectors inspect the structural quality of buildings. Before construction, they determine whether the plans for the building or other structure comply with local zoning regulations and are suited to the engineering and environmental demands of the building site. They visit the worksite before the foundation is poured to inspect the positioning and depth of the footings. They inspect the foundation after it has been completed. The size and type of structure and the rate of completion determine the frequency and number of other visits they must make. Upon completion of the project, they conduct a final comprehensive inspection. Some building inspectors may specialize, for example, in structural steel or reinforced concrete.

Electrical inspectors inspect the installation of electrical systems and equipment to insure that they work properly and are in compliance with electrical codes and standards. They visit worksites to inspect the installation of new and existing wiring, lighting, sound and security systems, an generating equipment. They also may inspect the installation of the electrical wiring or heating and air conditioning systems, kitchen appliances, and other components.

Mechanical inspectors inspect plumbing systems including septic tanks, plumbing fixtures and traps, water, sewer, and vent lines. They also inspect the installation of the mechanical components of kitchen appliances, heating and air-conditioning equipment, gasoline and butane tanks, gas piping, and gas fired appliances. Some specialize in boiler, mechanical components, or plumbing inspection.

Public works inspectors insure that Federal, State, and local government construction of water and sewer systems, highways, streets, bridges, and dams conform to detailed contract specifications. They inspect excavation and fill operations, the placement of forms for concrete, concrete mixing and pouring, and asphalt paving. They also record the amount of work performed and materials used so that contract payment calculations can be made. Public works inspectors may specialize in inspection of highways, reenforced concrete, or ditches.

Places of Employment

About 23,000 persons, nearly all of them men, worked as Federal, State, and local government construction inspectors in 1972. More than three-fourths worked for municipal or county building departments. Public works construction inspectors were employed primarily at the Federal and State level.

The employment of local government construction inspectors is concentrated in cities and in suburban areas undergoing rapid growth. They employ larger inspection staffs including most of the local construction inspectors who specialize in

structural steel, reenforced concrete, and boiler inspection.

About half the construction inspectors employed by the Federal Government work for the Department of Defense, primarily for the U.S. Army Corps of Engineers.

Training, Advancement, and Other Qualifications

To become a construction inspector, several years of experience is generally required as a construction contractor, supervisor, or craftsman. Federal, State, and most local governments also require an applicant to have a high school diploma.

Workers who want to become inspectors should have a thorough knowledge of construction materials and practices in either a general area like structural or heavy construction, or in a specialized area such as electrical or plumbing systems, reenforced concrete, or structural steel. Many employers prefer inspectors to be graduates of an apprenticeship program, to have studied at least two years toward an engineering or architectural degree, or to have a degree from a community or junior college, with courses in construction technology, blueprint reading, technical mathematics, English, and building inspection.

Construction inspectors must be in good physical condition in order to walk and climb about construction sites. They also must have a motor vehicle operator's license. In addition, Federal, State, and many local governments usually require that construction inspectors pass a civil service examination.

Construction inspectors receive most of their training on the job. During the first couple of weeks, they learn about inspection techniques; codes, ordinances, and regulations; contract specifications; and record-keeping and reporting duties by working with an experienced inspector. They begin by inspecting less complex types of construction such as residential buildings. The difficulty of their assignments is gradually increased until they are able to handle complex assignments. An engineering degree is frequently needed in order to advance to supervisory inspector.

The Federal Government and most State and large city governments conduct formal training programs for their construction inspectors to broaden their knowledge of construction materials, practices, and inspection techniques or acquaint them with new materials and practices. Inspectors who work for smaller local construction inspection agencies which do not conduct training programs frequently can broaden their knowledge of construction and upgrade their skills by attending State-conducted training programs or by taking college or correspondence courses.

Employment Outlook

Employment of government construction inspectors is expected to grow rapidly through the mid 1980's. Because of the increasing complexity of construction technology as well as the trend towards establishment by State governments of minimum professional standards for construction inspectors, job opportunities should be best for inspectors who have some college education or knowledge of a specialized type of construction.

In addition to growth needs, job openings for construction inspectors will occur each year to replace those who die, retire, or transfer to other occupations.

The rapid growth in employment of construction inspectors should result from population increases and continued expansion in residential construction. The demand for construction inspectors also should increase as they are given more responsibility for insuring quality workmanship and safe construction of prefabricated building materials and other components that are mass produced in factories and assembled on the construction site.

Earnings and Working Conditions

Starting salaries of construction inspectors working in cities and towns averaged $9,430 a year in 1972, according to a survey conducted by the Public Personnel Association. Top salaries for senior inspectors averaged $11,460. Salaries for supervisory inspectors were higher in large cities; they often received as much as $20,000 annually. Among geographic regions, the western region of the United States tended to have the highest salaries, cities in the southern region the lowest.

In the Federal Government, construction inspectors started at $7,694 or $9,520 a year in early 1973, depending on the amount and nature of their earlier work experience. Journeyman construction inspectors were paid salaries ranging from $11,614 to $15,097, and more experienced construction representatives were paid salaries ranging from $13,996 to $18,109.

Construction inspectors often spend a large portion of their time traveling between worksites. Usually, an automobile is furnished for their use or their expenses are reimbursed if they use their own. Since they spend the majority of their time outdoors or in partially enclosed structures, they are exposed to all types of inclement weather.

Unlike the seasonal and intermittent nature of employment in many of the occupations associated with

the construction industry, inspection work tends to be steady and year-round.

Sources of Additional Information

Persons seeking additional information on a career as a State or local government construction inspector should contact their State employment service, their local building department, or:

Secretariat of the National Conference of States on Building Codes and Standards, Building Research Division, National Bureau of Standards, Washington, D.C. 20234.

International Conference of Building Officials, 5360 Workman Mill Rd., Whittier, Calif. 90601.

Persons interested in a career as a construction inspector with the Federal Government can get information from:

Interagency Board of the U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

OTHER SERVICE OCCUPATIONS

MAIL CARRIERS

(D.O.T. 233.138 and 233.388)

Nature of the Work

Most mail carriers, commonly known as mailman, travel planned routes delivering and collecting mail. Carriers start work at the post office early in the morning, spend a few hours arranging their mail for delivery, readdress letters to be forwarded, and take care of other details such as signing receipts for postage-due and cash-on-delivery (c.o.d.) items.

A carrier typically covers the route on foot, toting a heavy load of mail in a leather bag or pushing it in a cart. In outlying suburban areas where houses are far apart a car or small truck is sometimes needed to deliver mail. Residential carriers cover their routes only once a day, but carriers assigned a business district may make two or more trips. Deliveries are made house-to-house except in large buildings, such as apartment houses, which have all the mail boxes on the first floor.

Besides making deliveries, carriers collect postage-due and c.o.d. fees and obtain signed receipts for registered and certain insured mail. If a customer is not home a notice is left that tells where special mail is being held. Carriers also pick up letters to be mailed.

After completing their routes, carriers return to the post office with mail gathered from street boxes and homes. They separate letters and parcels so that stamps can be canceled easily and turn in the receipts and money collected during the day.

Many carriers have more specialized duties than those described above. Some deliver only parcel post. Others collect mail from street boxes and office mail chutes. Rural carriers provide a wide variety of postal services. In addition to delivering and picking up mail, they may sell stamps and money orders and accept parcels and letters to be registered or insured.

All carriers answer customers' questions about postal regulations and service and provide change-of-address cards and other postal forms when requested.

Training, Other Qualifications, and Advancement

Mail carriers must be at least 18 and pass a four-part written examination. The first part tests reading accuracy by asking the applicant to compare pairs of addresses and indicate which are identical. The second part tests ability to follow oral instructions. The third measures general intelligence, including vocabulary, and the fourth tests ability to do simple arithmetic.

Applicants must have a driver's license and pass a road test if the job involves driving. They also must pass a physical examination and may be asked to show that they can lift and handle mail sacks weighing up to 70 pounds. Applicants who have had health conditions that might interfere with work must have a special review to determine their eligibility.

Applicants should apply at the post office where they wish to work because each post office keeps a separate list of those who have passed the examination. Applicants' names are listed in order of their scores. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. Disabled veterans who have a compensable, service-connected disability of 10 percent or more are placed at the top of the list. When a vacancy occurs, the appointing officer chooses one of the top three applicants; the rest of the names remain on the list to be considered for future openings.

Mail carriers are classified as casual, part-time flexible, part-time regular, or full-time. Casual workers are hired to help handle the Christmas mail. Part-time flexible employees do not have a regular work schedule but replace absent workers and help with extra work as the need arises. Part-time regulars have a set work schedule—for example, four hours a day.

New carriers are trained on the job. They begin as part-time flexible city carriers and become regular or full-time carriers in order of seniority as vacancies occur. Advancement possibilities are limited, but carriers can look forward to obtaining preferred routes as city carriers, or to jobs as rural carriers, as their seniority increases. The supervisory examination may be taken after 4 to 5 years of service.

Employment Outlook

Employment of mail carriers—who numbered 263,000 in 1972—is expected to grow slowly through the mid-1980's. Most job openings, however, will arise as a result of the need to replace experienced workers who retire, die, or transfer to other fields of work.

As population and business grows, mail volume is expected to increase and more carriers will be needed. Most openings will be for city carriers since most of the growth in population and business activity will be in urban and suburban areas. Little or no change is expected in rural carrier employment.

Earnings and Working Conditions

In mid-1972, wages of part-time flexible carriers began at $4.02 an hour, with periodic increases up to $5.31 an hour after 7 years of service. Hourly wages of part-time regulars were $3.88 an hour, with periodic increases up to $5.12 an hour after 7 years of service.

Full-time city carriers are paid on an annual basis, beginning at $8,072 and increasing to a maximum of $10,657 after 7 years. Those promoted to parcel-post carriers earn up to $11,448.

Rural carriers are paid a fixed annual salary plus an amount varying with the number of miles in their routes. They also receive an allowance of 12 cents a mile for the use of their automobiles. For example, as of July 1972, the salary of a carrier with a 61-mile route (the average length) would begin at $8,614 a year and increase to $11,199 after 7 years. The automobile allowance provides an extra $7.32 each work day. Substitute rural carriers receive the same pay as the regular carriers whose routes they are covering.

A full-time city carrier usually works an 8-hour day, 5 days a week. City carriers who work more than 8 hours a day or 40 hours a week are paid one and one-half times their regular rate of pay for the extra hours. City carriers who work either full or part-time receive 10 percent additional pay for work between 6 p.m. and 6 a.m. Rural carriers work either a 5- or 6-day week and do not receive overtime pay.

Most carriers begin work early in the morning, in some cases as early as 6 a.m. if they have routes in the business district. Carriers spend most of their time outdoors in all kinds of weather, walking from house to house with their heavy mailbags. Even those who drive must walk when making deliveries, and must lift heavy sacks of parcel post when loading their vehicles.

The job has its advantages, however. Carriers who begin work early in the morning are through by early afternoon. They are also free to work at their own pace as long as they cover their routes within a certain period of time.

(For information on fringe benefits, see the statement on postal service occupations elsewhere in the *Handbook*.)

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities for mail carriers.

TELEPHONE OPERATORS

(D.O.T. 235.862)

Nature of the Work

Although millions of telephone numbers are dialed each day without assistance, practically every one sometimes makes a call that requires help from the operator. Often the operator is asked to reverse long distance charges, locate an individual, or indicate the cost of the call. Frequently the customer needs a correct number. The operator also may be needed to contact the police in an emergency, assist a blind person who is unable to dial, or arrange a conference call for business executives in different locations.

These and many other services are provided by two groups of operators—those at switchboards in telephone company central offices and those at private branch exchange (PBX) switchboards. Usually operators place calls by inserting and removing plugs that make switchboard connections and by listening and speaking into their headsets. Some switchboards are operated by pushbuttons or dials.

Telephone company operators may be assigned to handle either long distance calls or give directory assistance. Long distance operators obtain the information needed to complete the call, make the necessary connections, and record the details for billing. *Directory assistance operators* (D.O.T. 235.862) look up and provide telephone numbers. Service assistants train and help new operators to complete difficult calls.

PBX operators (D.O.T. 235.862) run switchboards for business offices and other establishments. They connect interoffice or house calls, answer and relay outside calls, assist company employees in making outgoing calls, supply information to callers, and record charges. In many small establishments, PBX operators work at switchboards that serve only a limited number of telephones. These operators may do other office work such as typing or sorting mail and many also act as receptionists or information clerks. (The work of receptionists is described elsewhere in the *Handbook*.)

Places of Employment

About 400,000 telephone operators were employed in 1972; about three-fifths worked as operators in telephone companies and the rest as PBX operators in other types of businesses. A large number of PBX operators worked in manufacturing plants, hospitals, schools, and department stores. Telephone company and PBX operators tend to be concentrated in heavily populated areas. Nearly one-fifth of the total were employed in the New York, Chicago, and Los Angeles metropolitan areas.

Training, Other Qualifications, and Advancement

Men and women planning to become telephone operators should like to serve the public, be pleasant and courteous, and able to sit in a confined area for long periods. A clear and pleasing voice also is important. Most telephone companies and many large business firms require applicants to pass physical examinations and general aptitude tests.

New operators receive on-the-job training to become familiar with the equipment, records, and work. Operators first learn the procedures used to handle calls. Then they put through practice calls. After this instruction and practice—which usually lasts from 1 to 3 weeks—they are assigned to regular operator jobs and receive further instructions from supervisors.

PBX operators who handle routine calls may have a somewhat shorter training period than telephone company operators. In small businesses an experienced operator usually supervises the training. In large businesses, an instructor from the local telephone company may train new employees.

Experienced telephone company operators may be promoted to clerical, craft, or supervisory jobs. Similar opportunities exist for PBX operators in large firms; in many small businesses, however, opportunities for advancement are limited.

Employment Outlook

Employment of telephone and PBX operators as a group is expected to show no significant increase through the mid-1980's. Thousands of new workers, however, will be hired each year to replace experienced operators who transfer to other occupations, retire, or stop working for other reasons.

Although direct dialing and other changes have displaced many operators in the past, the number of telephone company operators has increased slightly recently due to the rise in number of directory assistance and long distance calls, and further increases are anticipated.

Because of the widespread use of Central Exchange (CENTREX), the number of PBX operators is expected to show little change. With CENTREX, incoming calls can be dialed direct to any extension without an operator's assistance, and outgoing and intercom calls can be dialed direct by the extension users. The number of new jobs created as more small and medium size businesses require PBX services, however, should about offset reduced demand for PBX operators among large firms converting over to CENTREX.

Earnings and Working Conditions

Telephone company operators in training averaged $2.67 an hour in early 1972; experienced operators $3.11; service assistants $3.90; and managers $5.21. Contracts between unions and telephone companies generally provide for periodic pay increases and extra pay for work on evenings, Sundays, and holidays.

Experienced PBX operators in metropolitan areas averaged $127.50 a week in early 1972; those who handle routine calls averaged $103.00 a week. Average earnings for PBX operators were highest in public utilities and lowest in retail trade and service industries.

Most telephone company and PBX operators work between 35 and 40 hours a week. Often, their scheduled hours are approximately the same as those of other clerical workers in the business community. In telephone companies, however, and in hotels, hospitals, and other places where telephone service is on a 24-hour basis operators usually work on shifts and on holidays and weekends. Some operators work split shifts—that is, they are on duty during the peak calling periods in the late morning and early evening, and have time off between these two periods.

Operators usually work in well-lighted and pleasant surroundings. Lounges often are provided for relaxation during "breaks" in their scheduled hours. Insurance, pension programs, holidays, vacations, and other fringe benefits are much the same as those for other types of clerical employees.

Many operators employed by telephone companies are members of the Communications Workers of America, the International Brotherhood of Electrical Workers, and the Alliance of Independent Telephone Unions.

Sources of Additional Information

For more details about employment opportunities, contact the telephone company in your community or local offices of the unions that represent telephone workers. General information on telephone operators is available from the following organizations:

Alliance of Independent Telephone Unions, P.O. Box 5462, Hamden, Conn. 16518.

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

Communication Workers of America, 1925 K St. NW., Washington, D.C. 20006.

EDUCATION AND RELATED OCCUPATIONS

The industrial and occupational structure of the Nation has gradually shifted from goods-producing to service-producing, white-collar activities. Accompanying this shift has been a continued rise in the educational achievement of the labor force—in part reflecting changing job requirements. People also have more time to spend on education and personal development.

Today about 3 out of 10 people of all ages participate in the educational process as students or teachers. Many more read and study on their own. The occupations of teachers and librarians play a vital role in the educational process and are covered in this section.

TEACHING OCCUPATIONS

Teaching is the largest of the professions; about 2.7 million full-time teachers were employed in 1972-73 in the Nation's elementary and secondary schools and colleges and universities. In addition, thousands taught part-time; among them were many scientists, physicians, accountants, members of other professions, and graduate students. Similarly, large numbers of craftsmen instructed part-time in vocational schools. Many other people taught in preschool and adult education and recreation programs.

No other profession offers women so many employment opportunities as teaching. About 1.7 million women are teachers, or nearly 2 1/2 times as many as are registered nurses, the second largest field of professional employment for women.

The number of teachers required depends on the number of students enrolled and the number of persons who leave the profession. New teachers also are needed to improve the student-teacher ratio.

Detailed information on how these demand factors are expected to affect the outlook for teachers through the mid-1980's is presented in the following statements.

KINDERGARTEN AND ELEMENTARY SCHOOL TEACHERS

(D.O.T. 092.228)

Nature of the Work

Kindergarten and elementary school teachers introduce children to science, numbers, language, and social studies, and develop students' capabilities in these subject areas. Their primary job is to provide a good learning environment and to plan and present programs of instruction using materials and methods designed to suit the students' needs.

Most elementary school teachers instruct a single group of 25 to 30 children in several subjects. In some schools two or more teachers "team teach" and are jointly responsible for a group of students or for a particular subject. A recent survey indicates that about 1 public elementary school teacher in 6 is team teaching.

An increasing number of elementary school teachers specialize in one or two selected subjects and teach these subjects to several classes; 1 teacher in every 5 teaches on this departmentalized basis. Some teach special subjects such as music, art, or physical education, while others teach basic subjects such as English, mathematics, or social studies.

Besides the actual student instruction, teachers participate in many activities outside the classroom. They generally must attend regularly scheduled faculty meetings and may serve on faculty committees. They must prepare lessons and evaluate student performance. They also work with students who require special help and confer with parents and other school staff. To stay up-to-date on educational materials and teaching techniques, they participate in workshops and other in-service activities.

New forms of instructional media give teachers more opportunities to work with students. Also, about 4 out of every 10 public elementary school teachers have aides who

generally do secretarial work and help supervise lunch and playground activities. Thus, growing numbers of teachers are freed from routine duties and can give more individual attention to students.

Places of Employment

More than 1.3 million people—85 percent of them women—worked as elementary school teachers in 1972. An increasing number of men, concentrated heavily in the upper grades, teach at the elementary level.

Most teachers work in public elementary schools that have six grades; however, some teach in middle schools—schools that cover the three or four years between the lower elementary grades and four years of high school. Only about 11 percent of elementary school teachers work in nonpublic schools.

More than one-third of all public elementary teachers teach in urban areas; about one-fifth in cities of 250,000 or more; one-eighth in rural areas; and the remainder in small towns or suburban areas.

Training, Other Qualifications, and Advancement

All 50 States and the District of Columbia require public elementary school teachers to be certified by the department of education in the State in which they work. Some States also require certification of teachers in private and parochial schools.

To qualify for certification, a teacher must study 4 years at an approved teacher education institution. Besides a bachelor's degree which provides the necessary liberal arts background, States require that prospective teachers have student-teaching and education courses.

In 1972, 11 States required teachers to get supplementary post-graduate education—usually a master's degree or a fifth year of study—within a certain period after their initial certification. Some States required U.S. citizenship; some an oath of allegiance; and several a health certificate.

Local school systems sometimes have additional requirements for employment. Students should write to the local superintendent of schools and to the State department of education for information on specific requirements in the area in which they want to teach.

In addition to educational and certification requirements, a teacher should be dependable, have good judgment, and should have the desire and ability to work with children. Enthusiasm for teaching and the competence to handle classroom situations also are important.

Opportunities for advancement in elementary teaching come principally with experience. Teachers may advance within a school system or transfer to another which recognizes experience and has a higher salary scale. Some teachers may advance to supervisory, administrative, or specialized positions.

Employment Outlook

Kindergarten and elementary school teachers are expected to face competition for jobs through the mid-1980's. If patterns of entry and reentry to the profession continue in line with past trends, the number of persons qualified to teach in elementary schools will exceed the number of openings.

Enrollment is the basic factor underlying the need for teachers. Because of fewer births in the sixties, elementary enrollments have been on the decline since they peaked at nearly 32 million in 1967. The U.S. Office of Education projects that by 1977 the downward enrollment trend will halt at a level of 29 million, and enrollments again will advance to nearly 35 million by 1985.

Besides new positions created by increasing enrollments, additional techers will be needed to replace those who are not now certified; to meet the expected pressure for an improved pupil-teacher ratio; and to fill positions vacated by teachers who retire, die, or leave the profession for other reasons. Many persons leave teaching at least temporarily to take on full-time homemaking or family responsibilities.

Recent college graduates qualified to teach at the elementary level and teachers seeking reentry to the profession make up the basic source of teacher supply. Through the mid-1980's reentrants to the field will face increasing competition from new graduates, and although reentrants have experience in their favor, beginning teachers may have an advantage because they command lower salaries and have more recent training.

While the outlook based on past trends points to a competitive employment situation through the mid-1980's, several factors could influence the demand for teachers. Increased emphasis on early childhood education, special programs for disadvantaged children, and individual instruction may result in larger enrollments, smaller student-teacher ratios, and consequently an increased need for teachers. However, possible budget restraints for educational services might limit program expansion.

A potential decline in the number of children born over the next decade could produce a decrease in the demand for teachers. While the trend has not been clearly established, women since 1970 have continued to have fewer children, and according to a 1972 survey, they expect to continue having smaller families than were common 10 years ago.

Earnings and Working Conditions

According to the National Education Association (NEA), public elementary teachers in 1972-73 averaged $9,823 a year. Average earnings in 1972 were about one and one-third times as much as the average earnings for nonsupervisory workers in private industry, except farming. In the five highest-paying States (Alaska, New York, Michigan, California, and New Jersey), teachers' salaries averaged more than $11,000; in the ten States having the lowest salaries (Mississippi, Arkansas, Idaho, South Dakota, Kentucky, Oklahoma, North Dakota, South Carolina, West Virginia, and Georgia), they averaged less than $8,000.

Public schools systems enrolling 6,000 or more pupils paid teachers with a bachelor's degree average starting salaries of $7,357 a year in 1972-73; those with a master's degree earned an average of $8,176.

Public elementary teachers worked an average of about 36-1/2 hours a week in 1972. Additional time spent preparing lessons, grading papers, making reports, attending meetings, and supervising extracurricular activities increased the total number of hours to about 46.

The elementary teacher usually works 9 months and averages 181 days in the classroom and 4 workdays on nonteaching activities. In addition, many teach summer sessions, and others take courses for professional growth or work at other jobs during the summer months.

Employment in teaching is steady, and business conditions usually do not affect the market for teachers. In 1972, 38 States and the District of Columbia had tenure laws that insured the jobs of teachers who had successfully taught for a certain number of years.

Collective bargaining agreements cover an increasingly large number of teachers. In early 1973, 30 States had enacted laws which required collective bargaining in the teacher contract negotiation process. More than one-half of the public school systems that enroll 1,000 students or more bargain with teacher organizations over wages, hours, and the terms and conditions of employment.

Sources of Additional Information

Information on schools and certification requirements is available from local school systems and State departments of education.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of general information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

National Educational Association, 1201 16th St. NW., Washington, D.C. 20036.

SECONDARY SCHOOL TEACHERS

(D.O.T. 091.228)

Nature of the Work

Secondary school teachers introduce students to subjects ranging from world history and elementary algebra to anthropology and computer mathematics. They help mold their students for future roles as citizens, homemakers, and jobholders.

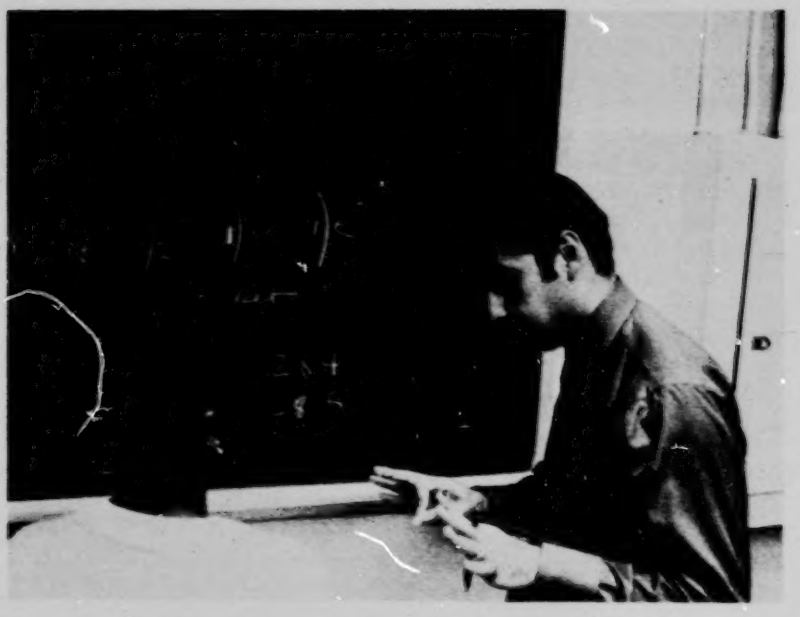
Secondary school teachers usually specialize in a particular field. English, mathematics, social studies, and science are the subjects most commonly taught. Other specialties include health and physical education, business education, home economics, foreign languages, and music. Increasingly, teachers are developing courses which deal with particular areas within the broad subjects so students may acquire in-depth as well as general knowledge of a field.

Secondary school teachers usually conduct classes in their specialty for 5 or 6 groups of students a day. The average daily pupil load for public school teachers is 134 students.

Teachers design their classroom presentation to meet the demands of a balanced curriculum and to suit the individual student's needs. Secondary school teachers instruct students at a single grade level or from different grades. They must consider the subject matter, as well as instructional methods and materials that best meet the students' needs.

Secondary school teachers also supervise study halls and homerooms, prepare lessons, grade papers, evaluate students, and attend meetings with parents and school personnel. Often they work with student groups outside of class. Teachers also participate in activities, such as workshops and college classes, to keep up-to-date on their subject specialty and on current trends in education.

Increasingly, in recent years, teachers have been able to devote more time towards improved instruction due to the increased availability of teacher aides who perform secretarial work, grade papers, and do other routine tasks. New developments in educational technology also have provided teachers with instructional media and other new materials and techniques to improve student learning.



A chemistry teacher provides his student with special help.

Places of Employment

More than 1 million teachers worked in secondary schools in 1972. Of these, about one-half were women.

According to a recent survey, slightly more than one-half of all public secondary teachers work in senior high schools; about one-third teach at the junior high level. About one-tenth teach in junior-senior high schools, and a very small number are elementary-secondary combination teachers.

Of those in public schools, about 1 teacher in 5 works in a city of 250,000 or more; 1 in 8 in a city of less than 250,000. Over one-half teach in small town or suburban schools; and about 1 in 7 in a rural location. Only about 1 teacher in 14 works in a nonpublic school.

Training, Other Qualifications, and Advancement

All 50 States and the District of Columbia require the certification of public secondary school teachers. Many States also require certification of secondary teachers in private and parochial schools.

In every State, the minimum educational requirement for certification is a bachelor's degree. Moreover, 12 States have specified that a secondary school teacher must get additional education, usually a fifth-year of study or a master's degree, within a certain period after beginning employment.

In 1972, the District of Columbia was the only jurisdiction requiring a master's degree for initial certification as a senior high school teacher. However, according to a recent national survey, 2 out of every 5 public secondary school teachers had a master's or higher degree.

The educational qualifications for secondary school teachers vary by State and by school system. Approved colleges and universities in every State offer programs which include the education courses and student-teaching that States require. They also offer the academic courses which qualify teachers in subject specialties taught at the secondary level.

States and local jurisdictions often have general teacher requirements, such as the recommendation of the college, a certificate of health, and citizenship. Prospective teachers may get complete information on such educational and general requirements from each State department of education and from the superintendent of schools in each community.

Personal qualifications which a secondary teacher must have include a desire to work with young people, an interest in a special subject, and the ability to motivate students and to relate knowledge to them.

For secondary teachers, education and experience provide the primary bases for advancement. Advancement to supervisory and administrative positions usually requires at least 1 year of professional education beyond the bachelor's degree and several years of successful classroom teaching. Some experienced teachers with special preparation may work as special school service personnel, such as school psychologists, educational specialists, or guidance counselors. Often these jobs require special certification as well as special education.

Employment Outlook

The supply of secondary school teachers through the mid-1980's will greatly exceed anticipated requirements if past trends of entry into the profession continue. As a result, prospective teachers are likely to face keen competition for jobs.

U.S. Office of Education projections indicate that enrollments in secondary schools will begin to decline in the mid-1970's after continuous

growth through the 1960's and into the early seventies. Enrollments are expected to increase slightly in the 1980's, but by 1985 are expected still to be below the 1972 level. Thus, over the 1972-85 period nearly all teaching positions will stem from the need to replace the tens of thousands of teachers who die, retire, or leave the profession for other reasons. Pressures for an improved pupil-teacher ratio and replacement of noncertified teachers will create additional openings.

At the same time demand is leveling off, the number of qualified graduates—the basic source of supply—will continue to grow rapidly, and other teachers will seek reentry to the profession. As a result, an increasing proportion of prospective teachers will have to consider alternatives to secondary school teaching. Many schools may favor hiring new graduates who command lower salaries and whose training is more recent rather than experienced reentrants.

Although the overall outlook for secondary teachers indicates a highly competitive market, employment conditions may be favorable in certain fields. A recent survey found continuing teacher shortages in mathematics, industrial arts, special education, and some vocational-technical subjects.

Earnings and Working Conditions

According to the National Education Association (NEA), public secondary school teachers in 1972-73 averaged $10,460. This is one and one-half times the average for nonsupervisory workers in private industry, except farming. NEA estimates indicate that 11 States (Alaska, New York, California, Michigan, Illinois, New Jersey, Maryland, Minnesota, Arizona, Nevada, and Connecticut) paid average annual salaries of $11,000 or more, and 3 (Mississippi, Arkansas, and Idaho) paid secondary school teachers less than $8,000 a year.

Beginning teachers with a bachelor's degree in school systems with enrollments of 6,000 or more earned average salaries of $7,357 in school year 1972–73. New teachers with a master's degree started at $8,176 a year. Beginning teachers could expect regular salary increases as they gained experience and additional education.

A recent survey of public school teachers indicated that the average required school week for those in secondary schools was 37 hours. However, when all teaching duties, including meetings, lesson preparation, and other necessary tasks are taken into consideration, the total number of hours spent working each week was slightly more than 48.

In some schools, teachers receive supplementary pay for certain school-related activities such as coaching students in sports and working with students in extracurricular music, dramatics, or school publications. About one-fourth of the public secondary teachers receive pay for extra duties, and one-third supplement their incomes with earnings from additional school work.

One-sixth of public school teachers also work in their school systems during the summer. More than one-fourth hold summer jobs outside the school system. In all, about three-fifths of public secondary school teachers have extra earnings from summer work, additional school-year work, or a combination of the two.

During the school-year, teachers work an average of 181 days. They average 26 teaching periods and 5 unassigned periods a week. Laws in 38 States and the District of Columbia ensure the employment of those who have achieved tenure status. Laws requiring collective bargaining of wages, hours, and the terms and conditions of employment cover increasing numbers of teachers.

Sources of Additional Information

Information on schools and certification requirements is available from local school systems and State departments of education.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of general information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

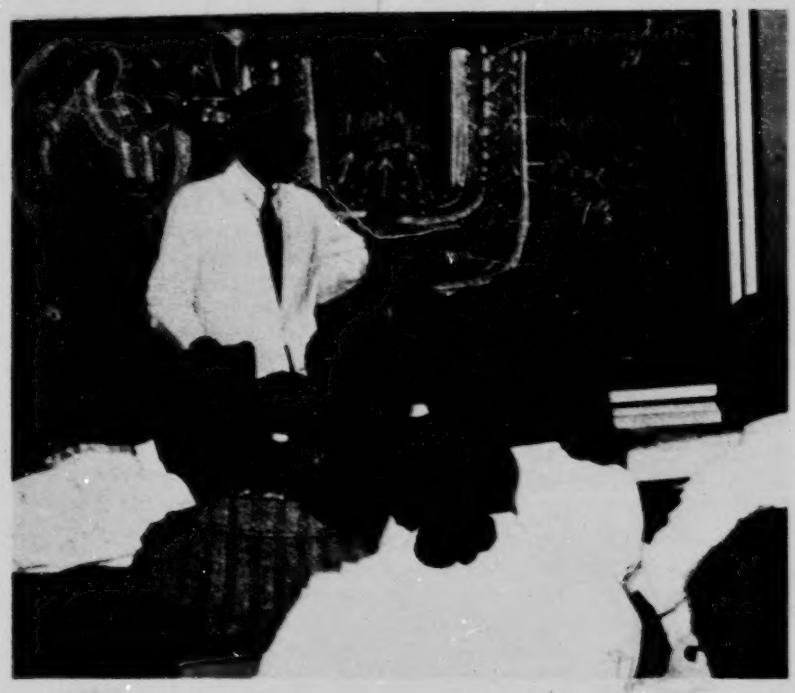
National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

COLLEGE AND UNIVERSITY TEACHERS

(D.O.T. 090.168 through .999)

Nature of the Work

About 60 percent of all persons in the United States between 18 and 21 attended college in 1972, compared with 40 percent ten years ago. To meet the demand of students for higher education, colleges and universities hire teachers to provide instruction in many fields. The most common subjects include the social sciences, teacher education, the physical sciences, health professions, fine and applied arts, English,



the biological sciences, mathematics, foreign languages, and business and commerce.

Slightly more than one-half of all college and university teachers instruct undergraduates; another one-third teach both graduates and undergraduates; and about one-tenth work only with graduate students.

Most teachers lecture and conduct classroom discussions to present subject matter effectively. Many work with students in laboratories. Some teachers provide individual instruction or supervise independent study. Nearly one-third of the faculty in universities have teaching assistants. Some college and university teachers use closed-circuit television, and especially in two-year colleges, instruction is machine-aided.

To be effective, college teachers must keep up with developments in their field by reading current material, participating in professional activities, and conducting research. Some publish books and articles. The importance of research and publication varies from one institutional level to another. In universities, about 70 percent of the faculty have published professional articles compared to 25 percent of 2-year college faculty. Also, in certain fields, such as engineering and the physical sciences, the demand for research is strong.

In addition to time spent on preparation, instruction, and evaluation, college and university teachers also participate in faculty activities; work with student organizations and individual students outside of classes; work with the college administration; and in other ways serve the institution and the community. Some are department chairmen and have supervisory duties.

Places of Employment

In 1972, about 620,000 teachers worked in more than 2,600 colleges and universities. An estimated 395,000—nearly two-thirds—were full-time senior staff. Of the remainder, about 110,000 were part-time senior staff, and nearly 20,000 were full-time junior instructors; the rest generally worked as part-time assistant instructors, teaching fellows, teaching assistants, or laboratory assistants.

Of full-time faculty, about one-third teach in universities; nearly one-half work in 4-year colleges; and about one-seventh teach in 2-year colleges. About two-thirds of the faculty in universities and 4-year colleges teach in public institutions; nearly nine-tenths of the faculty in two-year institutions work in public junior and community colleges.

In 1972, about one-fourth of all college and university teachers were women. Women worked more frequently in 2-year colleges than in 4-year colleges and universities and were more likely to teach certain subjects such as nursing, home economics, and library science. On the other hand, men were the principal instructors in agriculture, law, the earth sciences, engineering, and other subjects.

Training, Other Qualifications, and Advancement

Most college and university faculty are classified in four academic ranks: instructors, assistant professors, associate professors, and full professors. About one-fifth of all faculty are instructors; another one-fifth are professors. Slightly more than one-third are assistant professors; and one-fourth are associate professors.

To get an initial appointment, instructors generally must have a master's degree. For advancement to higher ranks, they need further academic training plus experience. Assistant professors usually need a

year of graduate study beyond the master's degree and at least a year or two of experience as an instructor. Appointments as associate professors frequently demand the doctoral degree and an additional 3 or more years of college teaching experience. For a full professorship, the doctorate and extensive teaching experience are essential.

In addition to advanced study and college-level teaching experience, outstanding academic, administrative, and professional contributions influence advancement. Research, publication, and work experience in a subject area may hasten advancement.

The ranks of college and university teachers and their educational backgrounds differ by institutional level. In universities, more than 50 percent of the faculty have doctoral degrees compared with less than 10 percent in 2-year colleges. Correspondingly, more than 50 percent of the faculty in universities are either professors or associate professors, while in 2-year colleges, only 1 teacher in 6 is within these upper ranks. Conversely, in community and junior colleges, where the master's is the highest degree held by nearly two-thirds of the faculty, instructors constitute a relatively large faculty segment.

Teachers should be able to motivate students and to adapt their field of study to students' needs and interests.

Employment Outlook

Entrants to college and university teaching are expected to face keen competition through the mid-1980's. Although the demand for teachers will continue to expand, the supply of new doctoral and master's degree graduates—the principal source of teacher supply—is expected to more than meet these needs.

College enrollment represents the basic factor underlying the demand for teachers. During the 1960's and early 1970's, teacher employment expanded due to growth in both the number of college-age persons and the proportion of 18- to 21-year olds enrolled in college. While the proportion attending college is expected to continue to rise, the number of college-age persons will decline after 1978, and by the early 1980's, enrollment will taper off and begin to fall. Over the 1972-85 period, the total number of college teachers needed is expected to rise only 20 percent. This compares with a more than 100 percent increase over the previous 13-year period.

Through the mid-1980's as demand is slowing, the numbers of both master's and Ph.D. degree recipients are expected to grow rapidly. Consequently, a smaller proportion of each year's degree recipients will be needed for college teaching. An increasing proportion of prospective college teachers, therefore, will have to seek nonacademic jobs. Alternative opportunities will exist in government and industry, which have traditionally competed with colleges and universities for Ph.D.'s and holders of master's degrees. Also, some of those persons holding graduate degrees may find it increasingly necessary to enter occupations that have not traditionally required advanced levels of study. Secondary school teaching may provide opportunities for an increasing number of master's graduates.

The employment outlook also depends on the institutional level and on the teacher's qualifications. Although enrollments in the 1970's are expected to stabilize in 4-year colleges and universities, many institutions, including junior and community colleges, may hire additional Ph.D.'s to upgrade their faculties. Master's graduates also will continue to find jobs in 2-year colleges. Public institutions are expected to continue to attract an increasing proportion of total college enrollment. Thus, opportunities in public colleges will be greater than in private institutions.

Earnings and Working Conditions

In 1972-73, full-time college and university faculty on 9-10 month contracts averaged $13,813, or twice the average earnings for nonsupervisory workers in private industry, except farming. Salaries varied, however, by teacher rank and by institutional level. Average salaries were:

Instructors	$10,662
Assistant professors	12,046
Associate professors	14,354
Professors	18,916

In general, larger institutions paid higher salaries. Salaries of teachers in 4-year colleges tended to be higher than those in 2-year colleges; university teachers averaged the highest salaries.

College and university teachers' salaries also vary by geographic region. According to a recent survey of 4-year colleges and universities, schools in the Mideast and New England paid the highest full-time faculty salaries.

Since about 2 out of 3 college teachers have 9-10 month contracts, many have additional summer earnings from research, writing for publication, or other employment. Royalties and fees for speaking engagements may provide additional earnings. Some teachers also undertake additional teaching or research projects or work as consultants.

College and university teachers also may enjoy certain benefits, including tuition waivers for dependents, housing allowances, travel allowances, and leaves of absence.

Colleges typically grant a semester's leave after 6 or 7 years of employment.

About 95 percent of all college and university teachers work in institutions which have tenure systems. Of the full-time teachers employed in these institutions, over one-half are tenured. Under a tenure system, a teacher usually receives 1-year contracts for a probationary period ranging from 3 to 7 years; some universities award 2- or 3-year contracts. After the probationary period, institutions consider teachers for tenure and the assurance of continuing employment with freedom from dimissal without cause.

The working hours and environment of college teachers generally are favorable. Classrooms, office facilities, and laboratories usually are well-equipped and teachers have access to library facilities and clerical assistance.

College teachers usually have flexible teaching schedules. According to a recent survey, the undergraduate faculty in 4-year colleges and universities normally teach 12 hours and usually no more than 14 or 15 hours a week. Graduate faculty have a teaching load of about 10 hours a week. In addition to time spent in the classroom, college and university teachers devote much time to preparation and other duties. Overall, full-time faculty spend about 40 hours a week on school-related activities. For faculty in junior and community colleges, the normal teaching load is slightly heavier, but the total number of hours on the job are fewer.

Sources of Additional Information

Information on college teaching as a career is available from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

American Association of University Professors, 1 Dupont Circle NW., Washington, D.C. 20036.

American Council on Education, 1 Dupont Circle NW., Washington, D.C. 20036.

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20065.

Professional societies in the various subject fields will generally provide information on teaching requirements and employment opportunities in their particular fields. Names and addresses of societies are given in the statements on specific professions elsewhere in the *Handbook*.

LIBRARY OCCUPATIONS

People in all walks of life are in the midst of an information explosion. Worlds that just a matter of a few years ago were beyond imagination are being explored, and information is growing at a rapid pace. Each day 1,000 books are printed.

Librarians and library technical assistants, described in detail in the following statements, serve people of all ages and lifestyles. They collect and organize books, periodicals, and other printed materials, as well as less conventional information such as microfilms and computer tapes for library users.

LIBRARIANS

(D.O.T. 100.118 through .388)

Nature of the Work

Making information available to people is the job of librarians. They select and organize collections of books, pamphlets, manuscripts, periodicals, clippings, and reports, and assist readers in their use. In many libraries, they also provide phonograph records, maps, slides, pictures, tapes, films, paintings, braille and talking books, microfilms, and computer tapes and programs.

Through the librarian, information in the library becomes available to users. Librarians classify and catalogue materials.

Two principal kinds of library work are reader and technical services. Librarians in reader services—for example, reference and children's librarians—work directly with the public. Librarians in technical services—for example, catalogers and acquisitions librarians—deal less frequently with the public; they order, classify, catalog, and in other ways prepare the materials for use.

The size of the library determines to a large extent the scope of a librarian's job. In small libraries, the job may include both technical and reader services. The librarian may select and organize materials, publicize services, do research, and give reference help to groups and individuals. In large libraries, librarians usually specialize in either technical or reader services. They may specialize further in certain areas, such as science, business, the arts, or medicine. Their work may involve reviewing and abstracting published materials and preparing bibliographies in their specialty.

Librarians generally are classified according to the type of library in which they work: public libraries, school media centers, college and university libraries, and special libraries.

Public librarians serve all kinds of people—children, students, research workers, housewives, teachers, and others. Increasingly, public librarians are providing special materials and services to culturally and educationally deprived persons, and to persons who because of physical handicaps cannot use conventional print.

The professional staff of a large public library system may include the chief librarian, an assistant chief, and several division heads who plan and coordinate the work of the entire library system. The system also may include librarians who supervise branch libraries and specialists in certain areas of library work. The duties of some of these specialists are briefly described as follows:

Reference librarian helps student find information.

Acquisition librarians purchase books and other materials and maintain a well-balanced library that meets the needs and interests of the public. *Catalogers* classify these materials by subject and otherwise describe them to help users find what they are looking for. *Reference librarians* answer specific questions and suggest sources of information that may be useful.

Some librarians work with specific groups of readers. *Children's* librarians serve the special needs of young people by finding books they will enjoy and showing them how to use the library. They may plan and conduct special programs such as story hours or film programs. Their work in serving children often includes working with school and community organizations. *Adult services librarians* serve adults by suggesting materials suited to their needs and interests. They may cooperate in planning and conducting education programs, such as community development, public affairs, creative arts, problems of the aging, and home and family life. *Young adult services librarians* help junior and senior high school students select and use books and other materials. They may organize programs of interest to young adults, such as book or film discussions or concerts of recorded popular and classical music. They also may coordinate the library's work with school programs. *Bookmobile librarians* offer library services to people not adequately served by a public library such as those in inner city neighborhoods, migrant camps, rural communities and institutions including hospitals and homes for the aged.

School media specialists instruct students in the use of the school library and help them choose from the media center's collection of print and non-print materials items that are related to their interests and to the subjects that they study in the classroom. Working with teachers and supervisors, school media specialists familiarize students with the library's resources. They prepare lists of materials on certain subjects and help select materials for school programs. They also select, order, and organize the library's materials. In some schools, media specialists may work with teachers to develop units of study and independent study programs, or they may participate in team teaching. Very large high schools may employ several media specialists, each responsible for a particular function of the library program or for a special subject area.

College and university librarians serve students, faculty members, and research workers in institutions of higher education. They may provide general reference service or may work in a particular subject field, such as law, medicine, economics, or music. Those working on university research projects operate documentation centers that use computers and other modern devices to record, store, and retrieve specialized information. College and university librarians may teach classes in the use of the library.

Special librarians work in libraries maintained by government agencies and by commercial and industrial firms, such as pharmaceutical companies, banks, advertising agencies, and research laboratories. They provide materials and services covering subjects of special interest to the organization. They build and arrange the organization's information resources to suit the needs of the library users. Special librarians assist users and may conduct literature searches, compile bibliographies, and in other ways provide information on a particular subject.

Others called *information science specialists*, like special librarians, work in technical libraries or information centers of commercial and industrial firms, government agencies and research centers. Although they perform many duties of special librarians, they must possess a more extensive technical and scientific background and a knowledge of new techniques for handling information. The information science specialist abstracts complicated information into short, readable form, and interprets and analyzes data for a highly specialized clientele. Among other duties, they develop classification systems, prepare coding and programming techniques for computerized information storage and retrieval systems, design information networks and develop microform technology.

Information on library technical assistants is found in a separate statement in the *Handbook*.

Places of Employment

Of the approximately 125,000 professional librarians in 1972, school librarians accounted for nearly one-half; public libraries and colleges and universities each employed about one-fifth. An estimated one-seventh worked in special libraries, including libraries in government agencies. Some librarians worked in correctional institutions, hospitals, and State institutions, while a small number served as consultants, State and Federal Government administrators, and teachers and administrators in schools of library science. The Federal Government employed more than 3,500 professional library administrators.

More than 85 percent of all librarians are women. In college and university libraries, however, men make up about 45 percent of the total professional staff. Men also are relatively numerous in law libraries and in special libraries concerned

with science and technology.

Most librarians work in cities and towns. Those attached to bookmobile units serve widely scattered population groups.

Training, Other Qualifications, and Advancement

A professional librarian ordinarily must complete a 1-year master's degree program in library science. A Ph.D. degree is an advantage to those who plan a teaching career in library schools or who aspire to a top administrative post, particularly in a college or university library or in a large library system. For those who are interested in the special libraries field, a master's degree or doctorate in the subject of the library's specialization is highly desirable.

In 1972, 49 library schools in the United States were accredited by the American Library Association and offered a master's degree in library science (M.L.S.). In addition, many other colleges offer graduate programs or courses within 4-year undergraduate programs.

Most graduate schools of library science require (1) graduation from an accredited 4-year college or university. (2) a good undergraduate record, and (3) a reading knowledge of at least one foreign language. Some schools also require introductory undergraduate courses in library science. Most prefer a liberal arts background with a major in an area such as the social sciences, the arts, or literature. Some schools require entrance examinations.

Special librarians and information science specialists must have extensive knowledge of their subject matter as well as training in library science. In libraries devoted to scientific information, librarians should be proficient in one or more foreign languages. They also must be well informed about new equipment, methods, and techniques used in storing and recalling technical information.

Most States require that public school librarians be certified and trained both as teachers and librarians. The specific education and experience necessary for certification vary according to State and the school district. The local superintendent of schools and the State department of education can provide information about specific requirements in an area.

In the Federal Government, beginning positions require completion of a 4-year college course and a master's degree in library science, or demonstration of the equivalent in experience and education by passing an examination.

Many students attend library schools under cooperative work-study programs by combining the academic program with practical work experience in a library. Scholarships for training in library science are available under certain State and Federal programs and from library schools, as well as from a number of the large libraries and library associations. Loans, assistantships, and financial aids also are available.

Librarians should be intellectually curious and able to express themselves verbally, and should have the desire and ability to search out and help others use library materials.

Experienced librarians may advance to administrative positions or to specialized work. Promotion to these positions, however, is limited primarily to those who have completed graduate training in a library school, or to those who have specialized training.

Employment Outlook

The employment outlook for librarians is expected to be favorable through the mid-1980's. Although employment in the field is expected to grow over the period to 1985, the supply of persons qualified for librarianship is likely to expand rapidly as an increasing number of new graduates and labor force reentrants seek jobs as librarians.

The anticipated increase in demand for librarians in the 1970's and early 1980's will not be nearly as great as it was in the 1960's. Then, school enrollments were rising rapidly and Federal expenditures supported a variety of library programs.

Fewer births during the 1960's will result in a slight decline in elementary and secondary school enrollments through the remainder of the 1970's; an upturn in enrollments is expected thereafter. The effect of birth rates in the 1960's will begin to be manifested in colleges and universities in the early 1980's, when total degree-credit enrollment is expected to level off. In both the schools and the colleges and universities, as a result, the demand for librarians will increase at a slower pace than in the past.

On the other hand, requirements for public librarians are expected to increase through 1985. The growth of an increasingly well-educated population will necessitate an increased number of librarians to serve the public. Also, the educationally disadvantaged, handicapped, and various minority groups will need qualified librarians to provide special services.

Employment of special librarians also will continue to grow. Because of ever-increasing demands upon high-level executives in business and industry, management will rely more heavily on special librarians and information specialists to keep abreast of new developments. Expanding use of computers to store and retrieve information will contribute to increased demand for information

specialists and library automation specialists.

In addition to openings from growth, thousands of job openings for librarians will occur each year to replace those who retire, die, transfer to other types of work, or leave the labor force.

Although overall employment opportunities are favorable, some librarians may have to compete for jobs of their choice. New graduates in commanding lower beginning salaries and in having more recent training may have an employment advantage over reentrants to the profession.

Employment opportunities will vary not only by type of library but also by the librarian's educational qualifications and area of specialization. Also, whether the librarian seeks a job in a large or small city, a suburb or town, or a rural area, and the region of the country in which a person wants to work will affect work employment prospects.

Earnings and Working Conditions

Salaries of librarians vary by type of library, individual's qualifications, and the size and geographical location of the library.

Starting salaries of graduates of American Library Association accredited library school programs averaged $9,248 a year in 1972, ranging from $8,713 in public libraries to $9,549, in school libraries. According to a recent survey, the average annual salary for special librarians was $13,900 in 1973. For librarians in college and university libraries, average salaries in 1972–73 ranged from $8,700 a year for librarians with limited experience working in private 4-year colleges to over $13,000 for university librarians with more extensive experience. Salaries for library administrators ranged somewhat higher. Department heads in college libraries generally earned between $10,000 and $14,000 a year.

In the Federal Government, the entrance salary for librarians with a master's degree in library science was $11,614 a year in early 1973.

The typical workweek for librarians is 5 days, ranging from 35 to 40 hours. The work schedule of public and college librarians may include some weekend and evening work. School librarians generally have the same workday schedule as classroom teachers. A 40-hour week during normal business hours is common for government and other special librarians.

The usual paid vacation after a year's service is 3 to 4 weeks. Vacations may be longer in school libraries, and somewhat shorter in those operated by business and industry. Many librarians are covered by sick leave; life, health, and accident insurance; and pension plans.

Sources of Additional Information

Additional information, particularly on accredited programs, and scholarships or loans may be obtained from:

American Library Association, 50 East Huron St., Chicago, Ill. 60611.

For information on requirements of special librarians write to:

Special Libraries Association, 235 Park Ave., South, New York, N.Y. 10003.

Information on Federal assistance for library training under the Higher Education Act of 1965 is available from:

Division of Library and Educational Facilities, Bureau of Libraries and Learning Resources, Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20202.

Those interested in a career in Federal Libraries should write to:

Secretariat Federal Library Committee, Room 310, Library of Congress, Washington, D.C. 20540.

Information on information science specialists may be obtained from:

American Society for Information Science, 1140 Connecticut Ave. NW., Washington, D.C. 20036.

Individual State library agencies can furnish information on scholarships available through their offices, on requirements for certification, and general information about career prospects in their regions. State boards of education can furnish information on certification requirements and job opportunities for school librarians.

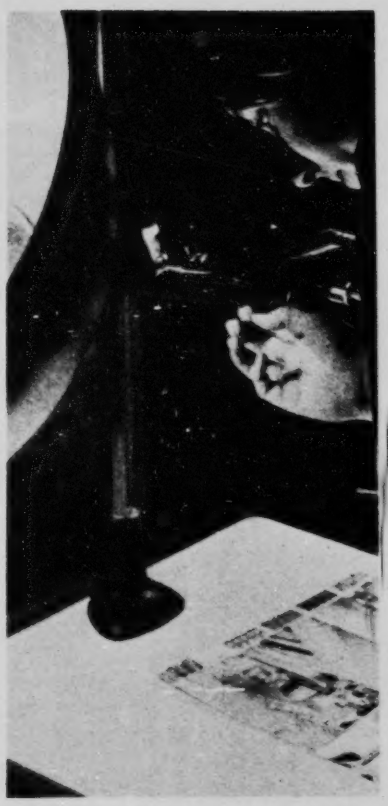
LIBRARY TECHNICAL ASSISTANTS

(D.O.T. 249.368)

Nature of the Work

Library technical assistants support and assist professional librarians in providing information. They are supervised by a librarian and have duties in either technical services or reader services.

In technical services, library technical assistants prepare the library's materials and equipment for reader use. For example, they may keep current files of special materials, such as newspaper clippings and pictures. They may operate and maintain audiovisual and data processing equipment, including slide projectors and tape recorders, as well as readers that magnify, project on a screen, and sometimes print out information on



Library technical assistant photographs magazine to make slides.

microfilm and microfiche cards. Library technical assistants also may perform many of the routine tasks involved in purchasing and processing library materials. The details of cataloging new books and other additions to the library's collection are often an important part of their job.

In reader's services, library technical assistants furnish information on library services, facilities, and rules, and answer questions that involve simple fact-finding in standard reference sources. They also assist readers in the use of catalogs and indexes to locate books and other materials. Library technical assistants may check-out, reserve, and receive materials that users borrow.

In some libraries, library technical assistants may supervise the work of others who handle routine duties that keep the library functioning.

Places of Employment

An estimated 25,000 people—four-fifths of them women—worked as library technical assistants in 1972. Most worked in large public libraries or in college and university libraries. Smaller numbers worked in school libraries and in medical, law, scientific, technical, and other special libraries.

In 1972, the Federal Government employed about 3,300 library technicians. These people worked chiefly in the Department of Defense and the Library of Congress, although many worked in small Federal libraries throughout the country.

Training, Other Qualifications, and Advancement

Library technical assistants may receive training for their work either on the job or in a formal post-high school program. Depending on the library, on-the-job programs generally require from 1 to 3 years to complete.

Junior or community colleges and technical institutes offer 2-year formal educational programs which lead to an associate or arts degree in library technology. Many people working in libraries take courses part-time to become certified or to get their degree.

Junior and community college programs generally include 1 year of liberal arts courses and a year of library-related study on purposes and organization of libraries, and on procedures and processes involved in operating a library. Students learn to order and process, catalog, and circulate library materials. Some receive training in data processing as it applies to libraries. Many learn to use and maintain audiovisual materials and equipment.

In 1972, 120 institutions offered library technical assistants training. These institutions—mostly 2-year colleges—are in over 30 States. Over the next several years, the number is expected to grow and formal training may become an established requirement for library technical assistants. Some programs teach skills for a particular type of library. Therefore, a prospective student should select a program with a knowledge of the curriculum, instructional facilities, faculty qualifications, and the kinds of jobs that graduates have found. Also, while programs may lead to an associate degree, credits earned in a library technology program may not apply toward a professional degree in library science.

A high school diploma or its equivalent is the standard requirement for both academic and on-the-job training programs. Many programs also require typing.

Library technical assistants should enjoy detail and have manual dexterity, verbal ability to explain procedures, and numerical ability to handle circulation statistics. Jobs may require much standing, stooping, bending, and reaching.

Employment Outlook

The employment outlook for library technical assistants is expected to be good through the mid-1980's particularly for graduates of academic programs. Opportunities are likely to be especially favorable in large public libraries and in college and university libraries.

Factors influencing the steadily growing demand for library technical assistants are population growth and expansion of library

service. Library technical assistants increasingly are performing some of the routine tasks formerly done by the professional staff.

In addition to openings created by growth, several thousand library technical assistants will be needed annually to replace those who die, retire, or transfer to other fields.

Earnings and Working Conditions

Salaries for library technical assistants vary widely depending on the size of the library or library system in which they work as well as the geographical location and size of the community.

In the Federal Government, salaries of library technicians generally ranged from $6,882 to $9,520 a year in early 1973. A few earned $11,614 a year, or more.

Library technical assistants in government and special libraries usually work a regular 40-hour week, but persons in public libraries and college and university libraries may have schedules that include weekend and evening hours. In schools, library technical assistants work during regular school hours.

Most libraries provide fringe benefits such as group insurance and retirement pay. Additional benefits offered by private businesses often include education assistance programs. Library technicians employed by the Federal Government receive the same benefits as other Federal workers.

Sources of Additional Information

Information on institutions offering programs for the training of library technical assistants, may write:

Council of Library Technical Assistants,
6800 South Wentworth Ave., Chicago,
Ill. 60621.

SALES OCCUPATIONS

Saleswork offers career opportunities for people who have completed high school as well as for college graduates, for those who want to travel and those who do not, and for salaried workers as well as men and women who wish to run their own businesses.

Workers in these jobs may sell for manufacturers, service firms, wholesalers, and retailers.

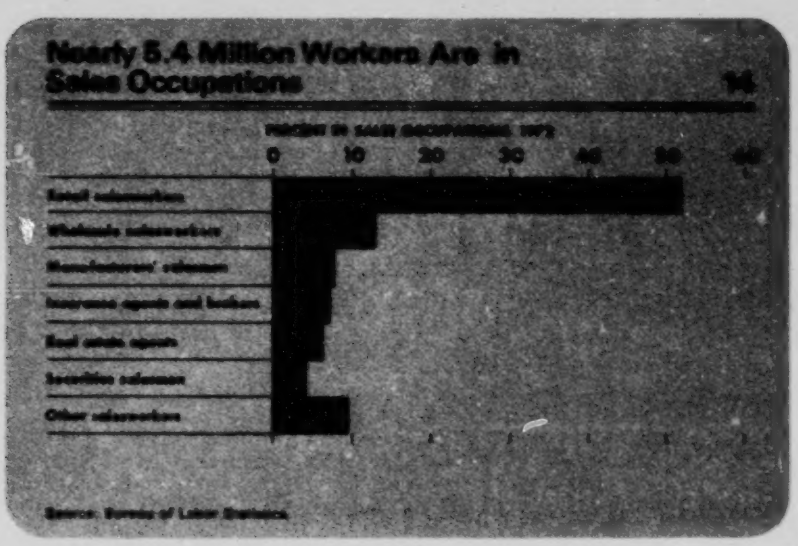
In 1972 about 5.4 million people, were in sales occupations; about 25 percent worked part-time. Forty percent were women who worked mainly in retail stores. Most salesworkers outside of retail stores were men. Chart 14 shows employment in the major sales occupations discussed in this section. The *Handbook* also includes individual statements for automotive salesworkers, automobile parts countermen, automobile service advisors, gasoline service attendants, models, and routemen.

Training, Other Qualifications, and Advancement

Training requirements for saleswork are as varied as the work itself. Salesworkers who sell standardized merchandise such as magazines, candy, cigarettes, and cosmetics usually are trained on the job by experienced salesclerks; in some large stores, they may attend brief training courses. The salesworker who sells complex products or services, such as electronic equipment or liability insurance, needs more education and training than most retail salesclerks. For some positions, salesworkers must be college graduates with majors in a field such as engineering. Others get the necessary technical knowledge from university or manufacturers' courses. Still others learn through years of on-the-job experience, often supplemented by home study. Thus, a real estate agent may take university extension courses; a department store beauty counselor may participate in an industry-sponsored training program; or a jewelry salesworker may learn through years of observation and study on the job.

Even in the most routine kinds of selling, a high school diploma is an asset to a beginner. Courses in business, as well as specialized courses in distributive education, are particularly good preparation. The Federal Government also sponsors training for some salesworkers under provisions of the Manpower Development and Training Act and other legislation.

Salesworkers must understand the needs and viewpoints of their customers and be poised and at ease with strangers. Other important attributes for selling are energy, self-confidence, imagination, self-discipline, and the ability to communicate. Arithmetic skills are an asset. In almost all saleswork except retail trade, salesworkers need initiative to locate prospective customers and to plan work schedules.



Employment Outlook

Employment in sales occupations is expected to rise moderately through the mid-1980's. In addition to jobs from growth, thousands of

openings will occur each year as workers die, retire, or leave for other reasons.

As employment rises, the proportion of part-time workers—already higher than in most occupational groups—also is likely to increase. Many part-time jobs will be in suburban shopping centers which have retail stores open several nights a week.

Further information about employment prospects for salesworkers in individual occupations, including retail trade, is given in statements that follow.

AUTOMOBILE PARTS COUNTERMEN

(D.O.T. 289.358)

Nature of the Work

Automobile parts countermen sell replacement parts and accessories for automobiles, trucks, and other motor vehicles. Most of them work in wholesale stores and automobile dealerships. They sell over the counter and take telephone orders for items such as piston rings, head gaskets, shock absorbers, rearview mirrors, and seat covers.

Parts countermen employed by wholesalers sell parts for many makes of automobiles and trucks to independent repair shops, service stations, self-employed mechanics, and "do-it-yourselfers." Countermen employed by dealers usually sell parts only for the makes of automobiles and trucks sold by the dealers. They may spend most of their time supplying parts to mechanics employed by the dealer.

Parts countermen identify and locate in the stockroom items the customer needs—often only from general description. By knowing parts catalogs and the layout of the stockroom they quickly can find any of several thousand items. If a customer needs a part that is not stocked, countermen may suggest one that is interchangeable, place a special order, or refer the customer elsewhere.

Parts countermen determine the prices of parts from lists, fill out sales receipts, and accept payments. When necessary they package items sold.

In addition to selling, countermen keep catalogs and price lists up to date, replenish stock, unpack and distribute incoming shipments, record sales, and take inventories. Large firms employ stock and receiving clerks to do some of the work.

Parts countermen use micrometers, calipers, fan belt measures, and other devices to measure parts for interchangeability. They also may use coil condenser testers, spark plug testers, and other equipment to find defective parts. In some firms, particularly small wholesale stores, they repair parts by using equipment such as brake riveting machines and brake drum lathes.

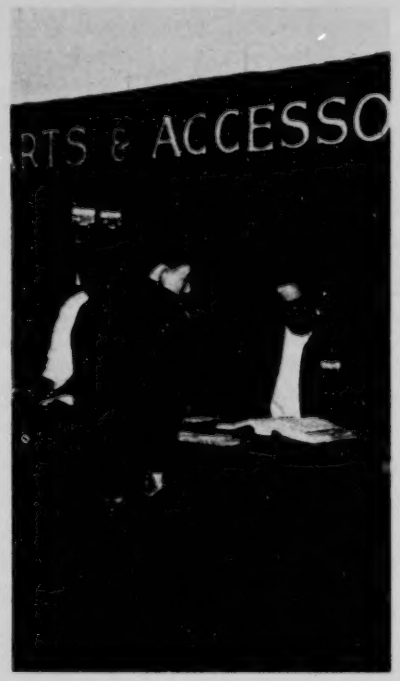
Places of Employment

Most of the estimated 72,000 automobile parts countermen employed in 1972 worked for automobile dealers and parts wholesalers. Most dealers employed one to four parts countermen; many wholesalers employed more than four. Other employers include truck dealers, retail automobile parts stores, and warehouse distributors of automotive parts. Trucking companies and buslines employ parts countermen to maintain stockrooms and dispense parts to mechanics who repair their fleets.

Parts countermen work throughout the country in dealerships and automobile parts wholesale stores. Those who work for warehouse distributors, trucking companies, and buslines are employed mainly in large cities.

Training, Other Qualifications, and Advancement

Automobile parts countermen should know the different types and functions of motor vehicle parts and be able to work with numbers. They should be neat, friendly, and tactful since they deal with the public. A good memory and the ability to write legibly and concentrate on details also are desirable. High school or vocational school courses in automobile mechanics, commercial arithmetic, salesmanship, and book-



Auto parts counterman looks in catalogue to get correct part.

keeping are helpful to young persons interested in becoming parts countermen. Practical experience from working in a gasoline service station or automobile repair shop, or working on cars as a hobby also is helpful. Employers generally prefer high school graduates for entry jobs.

Most parts countermen learn the trade on the job. Beginners usually are hired as parts delivery men or trainees. In some large firms, beginners start as stock or receiving clerks. Trainees gradually learn the different types of parts, the use of catalogs and price lists, and the layout of the stockroom. Although trainees may wait on customers after a few months' experience, generally about 2 years are required for a parts counterman to become fully qualified.

Parts countermen training programs for unemployed and underemployed workers were in operation in 1972 in several cities under the Manpower Development and Training Act. Persons who complete these programs, which usually last up to a year, may need additional on-the-job training to become fully qualified.

Parts countermen who have supervisory and business management ability may become parts department or store managers. Others may become "outside salesmen" for parts wholesalers and distributors. Salesmen call on automobile repair shops, service stations, trucking companies, and other businesses that buy parts and accessories in large quantities. Some parts countermen open their own automobile parts stores.

Employment Outlook

Employment of automobile parts countermen is expected to increase rapidly through the mid-1980's. In addition to jobs from employment growth, more than a thousand openings are expected annually to replace experienced workers who retire, die, or transfer to other occupations.

Employment will rise because more parts will be needed to repair the Nation's growing number of motor vehicles. Moreover, the variety of parts is expanding because manufacturers are producing a greater selection of makes, models, and optional equipment.

Earnings and Working Conditions

Automobile parts countermen are paid a weekly or monthly salary, or an hourly wage rate. In addition, they may receive commissions on sales. Parts countermen employed by automobile dealers in 34 large cities had estimated average earnings of $3.90 an hour in late 1972, slightly higher than the average for all nonsupervisory workers in private industry, except farming.

Most parts countermen work 40 to 48 hours a week. Many firms work half a day on Saturday.

Some employers provide paid holidays and vacations, and part or all of additional benefits such as life and health insurance. Others also contribute to retirement plans.

Stockrooms usually are clean and well lighted. The work is not physically strenuous, but parts countermen spend much time standing or walking. They have to work rapidly when waiting on customers and answering telephone calls at the same time.

Many parts countermen belong to unions including the following: the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

Details about employment opportunities may be obtained from local automobile dealers and parts wholesalers, locals of the unions previously mentioned, or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act and other training programs.

General information about the work of automobile parts countermen may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

National Automotive Parts Association, 29 East Madison St., Chicago, Ill. 60602.

AUTOMOBILE SALESWORKERS

(D.O.T. 280.358)

Nature of the Work

Automobile salesworkers are important links between dealers and car buyers. Many sell only new or used cars. Others, particularly those employed in small dealerships, sell both new and used cars, as well as trucks. (This statement does not discuss salesmen who sell trucks only.)

Automobile salesmen spend much time waiting on customers in the showroom or used-car lot. They determine the kind of car the customer wants by asking questions and encouraging comments about cars on display. For example, one customer may be interested primarily in economy, but another may be more impressed with styling and performance. The salesmen emphasize the points that satisfy the customers' desires and stimulate their willingness

to buy. To illustrate features such as smoothness of ride and ease of operation, the salesman may invite the customer to test drive the car.

Because cars are a major purchase, customers must be convinced that they are making a wise decision. Successful salesmen can overcome the customer's hesitancy to buy, and get the order. Since closing the sale frequently is difficult for beginners, experienced salesmen or sales managers often lend assistance. Salesmen may quote prices and trade-in allowances, but these figures usually require the approval of sales managers. Salesmen register cars and may get license plates and arrange financing and insurance for customers.

Before salesmen approve delivery, they make sure cars have been serviced properly and have the accessories specified by customers. They answer customers' questions on subjects such as the car's controls and the maintenance warranty. Following delivery, they may contact customers to express appreciation for their business and to inquire about the car. From time to time, salesmen also may send brochures on new-car models and other literature. By keeping in contact with customers, they build repeat business.

Salesmen develop and follow leads on prospective customers. For example, they obtain names of prospects from automobile registration records and dealer sales, service, and finance records. They also can obtain leads from gasoline service station operators, parking lot attendants, and others whose work brings them into frequent contact with people. Salesmen may contact prospects by phone or mail.

Places of Employment

Of the 130,000 persons who worked as automobile salesworkers in 1972, a small number were women. New-car dealers employed about 80 percent of the total and used-car dealers the remainder. Although many used-car dealers employ only 1 salesman, a few new-car dealers employ more than 50.

Automobile salesmen work throughout the country, but most are concentrated in heavily populated areas.

Training, Other Qualifications, and Advancement

Most beginners are trained on the job by sales managers and experienced salesmen. Many large dealers also provide several days of classroom training on obtaining customer leads, making sales presentations, and closing sales. Automobile manufacturers may furnish training manuals and other educational material. Experienced and beginning salesmen receive continuing guidance and training from sales managers, both on the job and at periodic sales meetings. Salesmen also may attend training programs offered by automobile manufacturers.

A high school diploma usually is the minimum educational requirement for beginners. Courses in public speaking, commercial arithmetic, English, business law, psychology, and salesmanship provide a good background for selling. Previous sales experience or other work requiring contact with the public is helpful. Many automobile salesmen previously worked as furniture salesmen, route salesmen, door-to-door salesmen, automobile parts countermen, or gasoline service station attendants. However, many sales managers will hire inexperienced appli-

cants who have satisfactory personal and educational qualifications.

Although age requirements for beginning salesmen vary, many employers prefer applicants who are at least in their mid- or late twenties. As a rule, however, 21 is the minimum age for beginners. Age requirements may be waived for a mature applicant.

Automobile salesworkers must be tactful, well-groomed, and able to express themselves well. Initiative and aggressiveness also are important, for the number of cars sold usually depends on the number of prospective customers contacted. Because automobile salesmen occasionally work for days without making a sale, they need self-confidence and determination to get through these slow periods.

Successful salesmen who have managerial ability may advance to assistant sales manager, sales manager, or general manager. Some sales managers and general managers open their own dealerships or become partners in dealerships.

Employment Outlook

Employment of automobile salesmen is expected to grow moderately through the mid-1980's as automobile sales increase. In addition to jobs resulting from employment growth, a few thousand openings will occur each year to replace salesmen who retire, die, or transfer to other occupations. Although selling cars is rewarding for many people, others seek new jobs because they are not suited for the work.

Increased car sales will cause employment to rise as population, multicar ownership, and personal incomes grow. Car sales generally fluctuate from year to year due to changes in business conditions, consumer preferences, and the availability of credit. Salesmen employment also fluctuates, but tends to be more stable than car sales.

Earnings and Working Conditions

Most salesmen are paid a commission based on the selling price of a car or the profit received by the dealer. Additional commissions may be paid when cars are financed and insured through the dealer. Although salesmen work year-round, their sales, and therefore their commissions, vary from month to month. So that commissioned salesmen will have a steady income, many dealers pay a modest weekly or monthly salary. Others advance salesmen money against future commissions. A few dealers pay salesmen a straight salary. Dealers may guarantee beginners a modest income for a few weeks or months. Thereafter, they are paid on the same basis as experienced salesmen.

Salesmen employed by new car dealers had estimated average weekly earnings of $224 in 1972. Earnings varied considerably, depending on individual ability and experience, geographic location, and dealership size. For example, salesmen employed by dealers that sold between 100 and 149 new vehicles annually averaged $168 a week, while those employed by dealers that sold 1,000 or more averaged $257.

Many dealers allow salesmen to use demonstrator cars free of charge. Others sell or lease demonstrators to salesmen at a discount, often at dealer's cost. Salesmen also receive discounts on cars bought for personal use. Most dealers provide paid vacations. Many also offer life and health insurance plans.

Because most customers find shopping after work convenient, salesmen frequently work evenings. In some areas, they may work on Sundays and take a day off during the week. Many dealers assign salesmen "floortime"—hours they spend in the showroom greeting customers. For example, a salesman may work in the showroom from 9 a.m. to 3 p.m. one week, from 3 p.m. to 9 p.m. the next week, and all day on Saturdays. When not assigned to the showroom, salesmen may spend a few hours each day delivering cars to customers and looking for new customers.

Details on employment opportunities may be obtained from local automobile dealers or the local office of the State employment service. General information about the work of automobile salesmen may be obtained from:

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

AUTOMOBILE SERVICE ADVISORS

(D.O.T. 620.281)

Nature of the Work

Many automobile dealers and some large independent garages employ service advisors to wait on customers who bring their automobiles for maintenance and repairs. The service advisor, sometimes called service salesman or service writer, confers with customers to determine their service needs and arranges for a mechanic to perform the work.

For a routine checkup, service advisors merely write the customer's requests on a repair order. However, when the customer complains of mechanical or electrical trouble, the advisor asks about the nature of the trouble and may test drive the automobile. For example, if the customer says his automobile is dif-

ficult to start, the advisor may try to find out if this happens when the engine is cold or after it warms up, and then writes a brief description of these symptoms on the repair order to help the mechanic locate the trouble. Service advisors also include the name of the customer and make of his automobile on the repair order. If a factory warranty covers the repairs, the engine and body numbers, mileage, and date of purchase are recorded.

Service advisors tell customers what repairs are needed, their approximate cost, and how long the work will take. If service advisors cannot tell the customer what repairs are needed until a mechanic has inspected the automobile, they phone him later for permission to do the work. They may advise on the necessity of having work done, by pointing out that it will assure improved performance, safer operation, and prevent more serious trouble. In addition to advising customers on service needs, they may sell accessories such as air-conditioners or radios.

Service advisors give repair orders to the shop dispatcher who then figures cost of repairs and assigns work to mechanics. In some shops, advisors compute repair costs. If a mechanic has questions about a repair order, he contacts the advisor who wrote it. After the mechanic has finished the work, the service advisor may test drive the automobile to be sure the problem has been corrected.

When the customer returns for his automobile, the service advisor answers questions regarding the repairs and settles complaints about their cost or quality. If the automobile is to be returned to the shop because the customer is dissatisfied or the cost of repairs is to be adjusted, the advisor usually must get permission from the service manager. In some dealerships, the most experienced service advisors substitute for service managers when they are absent.

Advisor writes repair order.

Places of Employment

More than 20,000 persons worked as service advisors in 1972; a small number were women. Most service advisors worked for large automobile dealers that employed from one to four advisors, but some worked for large independent automobile repair shops.

Training, Other Qualifications, and Advancement

Service advisors are trained on the job under the guidance of experienced service advisors and the service manager. In many shops, trainees begin by helping the service department dispatcher. They learn to route repair orders through the shop, to compute costs, and to determine the time required for different repairs. The beginner usually can become a qualified service advisor in 1 to 2 years, but learning to estimate the cost of automobile body repairs may take a longer time. In addition to on-the-job training, some advisors attend formal training programs conducted by automobile manufacturers.

For service advisor trainees, employers prefer high school graduates over 21 years of age with work experience in automobile repair or related activities. Employers usually promote young persons from within their own organizations. For example, a young person may apply for a job as service advisor trainee after gaining experience in the firm as a mechanic trainee or parts counterman trainee. Some firms, however, prefer to hire fully experienced mechanics.

Because service advisors deal directly with customers, employers look for applicants who are neat, courteous, even-tempered, attentive listeners, and good conversationalists. High school and vocational school courses in automobile mechanics, commercial arithmetic, salesmanship, public speaking, and English are helpful.

Service advisors with supervisory ability may advance to shop foremen or to service managers. Some open their own automobile repair shops.

Employment Outlook

Employment of automobile service advisors is expected to increase rapidly through the mid-1980's as a result of the increasing number of automobiles. In addition to the job openings resulting from employment growth, a few hundred openings are expected each year to replace experienced service advisors who retire, die, or transfer to other occupations.

The number of automobiles is expected to grow as population, con-

sumer purchasing power, and multi-car ownership increase. More automobiles and their increasing complexity will require additional service advisors. Also, some small dealers are expected to hire service advisors as work increases.

Earnings and Working Conditions

Service advisors employed by automobile dealers in 34 large cities had estimated average earnings of $5.03 an hour in late 1972, more than one-third higher than the average for all nonsupervisory workers in private industry, except farming.

Many service advisors are paid a salary plus commission; others are paid a straight commission. Commissions usually are based on both the cost of repairs and the price of accessories sold. Commissions may vary as the amount of repair work fluctuates.

Many employers provide paid holidays and vacations, and pay all or part of the cost of life and health insurance. Others also contribute to retirement plans. Many employers furnish laundered uniforms.

Most service advisors work 40 to 48 hours a week. They are busiest in the early morning when most customers bring their cars for repairs, and in late afternoon when they return. During these peak hours advisors may be rushed to wait on customers.

Service advisors stand much of the time and may be outdoors in all kinds of weather, but their work is not physically strenuous. Occasionally, they have to deal with disgruntled customers, but most customers are pleasant.

Unions that organize service advisors include the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffers, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

Details on employment opportunities may be obtained from local automobile dealers or repair shops; locals of the unions previously mentioned; or the local office of the State employment service.

General information about the work of automobile service advisors may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils of America, Inc., 4001 Warren Blvd., Hillside, Ill. 60162.

GASOLINE SERVICE STATION ATTENDANTS

(D.O.T. 915.867)

Nature of the Work

Gasoline service station attendants (also called gasoline station salesmen or servicemen) help keep the Nation's 115 million motor vehicles running and in good operating condition.

Service station attendants pump gasoline, clean windshields, and offer the additional services of checking water level, oil level, and tire air pressure. They also may check the tires, fan belt, and other parts for excessive wear.

Attendants have other responsibilities besides servicing cars. They sell and install parts and accessories such as tires, batteries, fan belts, and windshield wiper blades. When a customer pays the bill, attendants either make change or prepare a charge slip. They may perform minor maintenance and repair work, such as changing oil, rotating tires, repairing tires, or replacing a muffler. Some attendants, called mechanic-attendants, perform more difficult repairs.

Attendants also may keep the service areas, building, and restrooms clean and neat. In some stations, they help the station manager take inventory, set up displays, and perform other duties associated with the operation of a small business.

If a service station provides emergency road service, attendants occasionally may drive a tow truck to a disabled car to "boost" the battery, change a flat tire, or perform other minor repairs. If more extensive repairs are needed, they tow the customer's vehicle back to the service station.

Gasoline service station attendants may use simple handtools such as screwdrivers, pliers, and wrenches, and power tools such as pneumatic wrenches. Mechanic-attendants frequently use more complex equipment, such as motor analyzers and wheel alignment machines.

Places of Employment

About 435,000 people worked as gasoline service station attendants in 1972. More than one-third of these were part-time employees. In addition to attendants, more than 225,000 gasoline service station managers and owners did similar work.

Service station attendants work in every section of the country, in the largest cities, in the smallest towns, and in outlying areas.

Training, Other Qualifications, and Advancement

Applicants for jobs as gasoline ser-

vice station attendants should have a driver's license, a general understanding of how an automobile works, and some sales ability. They should be friendly and able to speak well, present a generally neat appearance, and have self-confidence. Applicants should know simple arithmetic so they can make change quickly and accurately and help keep business records. They also should be familiar with local roads, highways, and points of interest in order to give directions to strangers and to locate vehicles whose owners have called for road service.

Although completion of high school is not generally a requirement for getting an entry job, it is an advantage because it indicates to many employers that a young person can "finish a job." A high school education usually is required for service station management training programs conducted by oil companies.

Service station attendants usually are trained on the job, although there are some formal training programs. Attendants who train on the job do relatively simple work at first, such as cleaning the station, pumping gas, and cleaning windshields. Gradually, they progress to more advanced work such as doing simple maintenance, installing accessories on cars, and helping to keep the station records. It usually takes from several months to a year to become fully qualified.

Formal training programs for gasoline service station work are offered in many high schools around the country. In this curriculum, students in their last 2 years of high school take business education courses and work part-time in a gasoline service station, where they receive instruction in all phases of service station work.

Some attendants are enrolled in formal training programs for service stations managers, which are conducted by most major oil companies. These programs usually last from 2 to 8 weeks and emphasize subjects such as simple automobile maintenance, salesmanship, and business management.

Several avenues of advancement are open to gasoline service station attendants. Additional training qualifies attendants to become automobile mechanics; those having business management capabilities may advance to station manager. Many experienced station managers and automobile mechanics go into business for themselves by leasing a station from an oil company or by buying their own station. Oil companies hire some service station managers as salesmen or district managers.

Employment Outlook

Employment of gasoline service station attendants is expected to increase moderately through the mid-1980's. In addition to the job openings from employment growth, thousands of openings are expected each year from the need to replace attendants who retire, die, or transfer to

other occupations.

Increased employment of service station attendants is expected due to the growing consumption of gasoline and other service station products. The number of motor vehicles is expected to rise because of growing population and income, multiple car ownership, and the continuing movement to the suburbs. Also, greater use of cars is expected as families have more leisure time. Continued fuel shortages, however, may adversely affect highway travel.

More attendants also may be needed to perform additional maintenance on newer, more complex cars. For example, more cars will have devices that reduce exhaust fumes, and these devices must be serviced periodically.

Earnings and Working Conditions

Earnings of gasoline service station attendants vary considerably. Hourly earnings for many attendants ranged from $2.00 to $3.00 in 1972, according to the limited information available. Attendants employed in large metropolitan areas generally had higher earnings than those in small towns.

In many stations, employers provide fringe benefits such as health insurance and paid vacations. Some employers furnish uniforms and pay for their cleaning. More than one-half of the attendants work over 40 hours a week; many work more than 48 hours. Attendants frequently work at night and on weekends and holidays.

Attendants work outdoors in all kinds of weather. They do considerable lifting and stooping and spend much time on their feet. Possible injuries include cuts from sharp tools and burns from hot engines. For many attendants, however, the opportunity to deal with people and the possibility of someday managing their own service stations more than offset these disadvantages. For others, the opportunity to get part-time employment is important.

Some college students have been able to work their way through school as service station attendants. Some workers also supplement their income from regular jobs by working part-time as attendants.

Sources of Additional Information

For more details about work opportunities, contact local gasoline service stations or the local office of the State employment service.

INSURANCE AGENTS AND BROKERS

(D.O.T. 250.258)

Nature of the Work

Insurance agents and brokers sell policies that protect individuals and businesses against future losses and financial pressures. They may help plan financial protection to meet the special needs of a customer's family; advise about insurance protection for an automobile, home, business, or other property; or help a policyholder obtain settlement of an insurance claim.

Agents and brokers usually sell one or more of the three basic types of insurance: life, property/liability, and health. Life insurance policies pay survivors when a policyholder dies; they also may provide retirement income, funds for the education of children, and other benefits. Property/liability insurance protects policyholders from financial losses as a result of automobile accidents, fire and theft, or other hazards. Health insurance policies offer protection against the costs of hospital and medical care or loss of income due to illness or injury. Many agents also offer securities, such as mutual fund shares.

An insurance agent may be either an insurance company salesworker or an independent business person authorized to represent one or more insurance companies. Brokers, on the other hand, are not under contract with any company; they place policies directly with the company that best meets a client's needs. Otherwise, agents and brokers do much the same kind of work.

Agents and brokers spend most of their time discussing insurance policies with prospective and existing customers. Some time must be spent in office work to prepare reports, maintain records, plan insurance programs that are tailored to prospects' needs, and draw up lists of prospective customers. Specialists in group policies may help an employer's accountants set up a system of payroll deductions for employees covered by the policy.

Places of Employment

About 385,000 agents and brokers—90 percent of them men—sold insurance full time in 1972. Many others worked part time. About half specialized in life insurance; the rest, in some type of property/liability insurance. Almost all also sold health insurance.

Agents and brokers are employed in cities and towns throughout the country, but most work near large population centers.

Training, Other Qualifications, and Advancement

Although some employers prefer

Agent discusses policy with customer.

college graduates for jobs selling insurance, most hire high school graduates with work experience. College training may help the agent grasp the fundamentals and procedures of insurance selling more quickly. Courses in accounting, economics, finance, business law, and insurance subjects are helpful.

All agents and most brokers must be licensed in the States where they plan to sell insurance. In most States, licenses are issued only to applicants who pass written examinations covering insurance fundamentals and the State insurance laws. New agents usually receive training at insurance company home offices or at the agencies where they will work. Beginners sometimes attend company-sponsored classes to prepare for examinations. Others study on their own and accompany experienced salesworkers when they call on prospective clients.

Agents and brokers can broaden their knowledge of the insurance business by taking courses at colleges and universities and attending institutes, conferences, and seminars sponsored by insurance organizations. The Life Underwriter Training Council (LUTC) awards a diploma in life insurance marketing to agents who successfully complete the Council's 2-year life program. They also offer other courses in life and health insurance. As an agent or broker gains experience and knowledge, he can qualify for the Chartered Life Underwriter (CLU) designation by passing a series of examinations given by the American Society of Chartered Life Underwriters. In much the same way, a property/liability agent can qualify for the Chartered Property Casualty Underwriter (CPCU) designation by passing an examination given by the American Institute for Property and Liability Underwriters, Inc. The CLU and CPCU designations are recognized marks of achievement in their respective fields.

Agents and brokers should be enthusiastic, self-confident, and able to communicate effectively with different types of people. Because agents usually work without supervision, they need initiative to locate new prospects. For this reason, many employers seek people who have been successful in other jobs.

Insurance agents who show unusual sales ability and leadership may be promoted to sales manager in a district office or to a managerial job in a home office. A few agents may advance to top positions as agency superintendents or company vice-presidents. Many who have built up a good clientele prefer to remain in sales work. Some, particularly in the property/liability field, eventually establish their own independent agencies or brokerage firms.

Employment Outlook

Employment of insurance agents and brokers is expected to grow moderately through the mid-1980's as the volume of insurance sales continues to expand. Many additional jobs will open as agents and brokers die, retire, or leave their jobs to seek other work. Due to the competitive nature of insurance selling, beginners often leave their jobs because they have been unable to establish a successful clientele.

As personal incomes rise and life expectancy increases, more families will depend on life insurance for educational funds for their children and retirement income. Expansion in industrial plant and equipment and a growing number of major consumer purchases, such as homes or automobiles, will stimulate sales of property/liability insurance. Rising medical costs will increase sales of health insurance.

Employment of agents and brokers, however, is not expected to keep pace with growing insurance sales because more policies will be sold to groups and by mail. Also,

agents should be able to handle more business as computers relieve them of time-consuming clerical tasks.

Earnings and Working Conditions

Beginners in this occupation often are guaranteed moderate salaries or advances on commissions while they are learning the business and building a clientele. Thereafter, most agents are paid a commission. The size of the commission depends on the type and amount of insurance sold, and whether the transaction is a new policy or a renewal. After a few years, an agent's commissions on new policies and renewals may range from $8,000 to $20,000 annually. A number of established and highly successful agents and brokers earn more than $30,000 a year.

Agents and brokers generally pay their own automobile and traveling expenses. In addition, those who own and operate independent businesses must pay office rent, clerical salaries, and other operating expenses out of their earnings.

Although insurance agents usually are free to arrange their own hours of work, they often schedule appointments during evenings and weekends for the convenience of clients. Some agents work more than the customary 40 hours a week. (See the statement on the Insurance Industry for more information about work in life and property/liability companies.)

Sources of Additional Information

General occupational information about insurance agents and brokers may be obtained from the home office of many life and property/liability insurance companies. Information on State licensing requirements may be obtained from the department of insurance at any State capital.

Information about a career as a life insurance agent also is available from:

Institute of Life Insurance, 227 Park Ave., New York, N.Y. 10017.

Life Insurance Agency Management Association, 170 Sigourney St., Hartford, Conn., 06105.

The National Association of Life Underwriters, 1922 F St., NW., Washington, D.C. 20006.

Information about sales training in life and health insurance is available from:

The Life Underwriter Training Council, 1922 F St. NW., Washington, D.C. 20006.

Information about property/liability agents and brokers can be obtained from:

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

National Association of Insurance Agents, Inc., 85 John St., New York, N.Y. 10038.

MODELS

(D.O.T. 297.868 and 961.868)

Nature of the Work

Models convey the idea that life can become happier, more glamorous, or secure if people buy the products or use the services they advertise. The attractive female model or handsome male model furnishes the indispensable image that can trigger public demand for a new look or product.

Most models specialize in some line of live or photographic work.

Some *fashion models* work before an audience, often by participating in style shows. Models walk past customers and pause to exhibit favorable features of the clothes they are wearing. On some jobs they may stop to tell individual customers a garment's price and style number. Fashion models who work for clothing designers, manufacturers, and distributors are called showroom or wholesale models. They work constantly during peak seasons, but during slack times they may have clerical duties such as typing.

Informal models work in department stores and custom salons where the pace is more leisurely than in showrooms. Still others, may demonstrate new products and services at manufacturers' exhibits and trade shows.

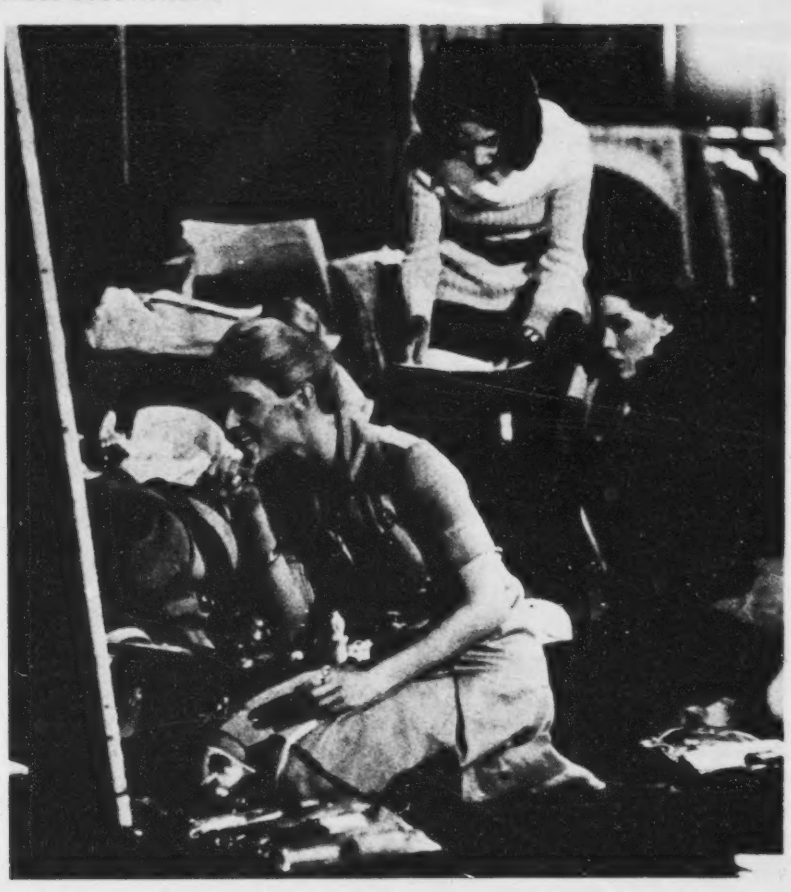
Photographic models usually are hired on an assignment basis. After arriving for an assignment, the model changes into the appropriate clothing. The photographer then decides on poses, adjusts lights, and takes several pictures. Most photographic models display fashions, but some pose with other merchandise such as cars or china.

In addition to fashion and photographic work, some models pose for artists or sculptors, or work in films or television. Models available for all types of assignments are known as free-lancers. They work on their own or through a model agency which schedules clients' assignments.

Places of Employment

More than 7,000 persons worked as full-time models in 1972; many others had part-time modeling jobs. Most models are women. Although models work in nearly all urban areas, most jobs are in New York City, the center of the fashion industry. Large numbers also work in Chicago and Los Angeles.

Manufacturers, designers, and wholesalers employ the largest



Models prepare to pose.

number of full-time models. In New York City's garment district, hundreds of firms and designers employ one or two permanent models. Some models work for advertising agencies, retail stores, and magazines; others are hired by artists, photographers, and sculptors.

Training, Other Qualifications, and Advancement

Prospective models should know hair styling, and the use of makeup, and the proper way to walk and stand. Modeling schools and many agencies in large cities provide this instruction. In photographic modeling courses, students are taught to pose for the photographer and to show different emotions before the camera. Although employers have no specific educational requirements, some models complete high school and others have college training. Courses in art, drama, dancing, and fashion design can develop poise and a sense of style.

Fashion models must be well proportioned and slim to fit manufacturers' samples. A female shoe model generally must wear size 5, and a hosiery model needs long and graceful legs. The male model should wear trim clothing—usually a size 40 or 41 long suit.

Because photographs distort images and emphasize undesirable traits, photograhic models usually are thinner than other models and have fine physical features. Female photographic models, for instance, must be long-waisted and at least 5 feet 7 inches tall. They also need good teeth and a face that is pretty or reflects the style of the period.

Models should like working as part of a team. The ability to withstand the pressures of competition, close schedules, and quick changes is important. Sometimes they work under uncomfortable conditions, such as modeling furs in the summer or swim suits in winter. The job demands not only perfect grooming, poise, and a pleasant personality, but also physical stamina and a generous helping of determination.

Placement offices at modeling schools provide jobs for many students. Some jobseekers find employment by registering at a model agency. An agency usually asks the applicant for photos in a number of modeling poses to show prospective clients. Department stores may hold auditions that give inexperienced models a chance to show the newest styles. In addition, many sales jobs in department stores provide useful experiences in handling clothing, observing customers, and occasional modeling. Sometimes a model can gain experience in local fashion shows given to raise funds for charity.

Modeling can be a stepping stone to other jobs in the fashion field, such as fashion coordinator, staff editor of a fashion magazine, or fashion consultant. Models who work as doubles or stand-ins in movies or television may become actors or actresses. Some work their way through art school by modeling and then qualify for jobs as fashion illustrators.

Employment Outlook

Full-time modeling will remain highly competitive through the mid-1980's. Because young people are attracted by the glamour of this occupation, the number of job hunters is expected to be much larger than the number of full-time jobs. Opportunities for part-time work, however, should be favorable.

Employment of models is expected to increase moderately during the next decade as apparel manufacturing and sales expand. As the competition for sales grows, manufacturers will stress advertising, and this emphasis on product promotion will contribute to the demand for models.

Most openings for models will be to replace those who leave the field. Many high fashion models have to retire when they lose their youthful appearance, and others are eased out of the field because they are identified with outdated products. Although a female model seldom works more than 8 years, a male model often works 20 years or more.

Earnings and Working Conditions

A model's earnings depend chiefly on the number of assignments and their length. Although a few top models make as much as many top executives, most earn far less. According to the limited information available, fashion models working full time for manufacturers or wholesalers earned from $125 to $200 a week in 1972. Models working for New York City retail stores were paid from $110 to $180 a week, and those working outside of New York from $80 to $120.

Free-lance models charge their clients fees. Those working through agencies pay a commission to the agency. In 1972, free-lance models working in fashion shows averaged $50 an hour in New York City. Photographic models in New York earned $40 to $75 an hour. These rates are misleading because many models, especially beginners, work only a few hours each week. Although photographic modeling often pays well, many models must provide their own accessories and pay for other expenses such as transportation. Occasionally, a complete outfit is needed to get a job.

Television models earn at least $35 for an appearance as an extra, and about $135 for an appearance as a principal character; they are paid an additional amount for each rerun. Television models must be members of the American Federation of Television and Radio Artists or the Screen Actors Guild, Inc.

Modeling may influence personal life. Because the camera highlights the effects of keeping late hours, for example, a model may limit evenings out to be fresh for the next day's work. In addition, a female model must spend part of each night on beauty care, and sometimes prepares clothing and accessories for the next day.

Sources of Additional Information

Employers of models such as magazines and newspapers may be able to recommend reputable modeling agencies or schools to those interested.

A list of approved modeling schools is available from individual State Departments of Education. Write the directors of particular modeling schools for catalogs describing the program, entrance requirements, and tuition costs.

MANUFACTURERS' SALESWORKERS

(D.O.T. 260. through 289.458)

Nature of the Work

Practically all manufacturers—whether they make computers or can openers—employ salesworkers. Manufacturers' salesworkers sell mainly to other businesses—factories, railroads, banks, wholesalers, and retailers. They also sell to hospitals, schools, and other institutions.

Most manufacturers' salesworkers sell nontechnical products. They must be well informed about their firms' products and also about the special requirements of their customers. When salesworkers visit firms in their territory, they use an approach adapted to the particular line of merchandise. A salesworker who handles crackers or cookies, for example, emphasizes the wholesomeness, attractive packaging, and variety of these products. Sometimes salesworkers promote their products by displays in hotels and conferences with wholesalers and other customers.

Salesworkers who deal in highly technical products, such as electronic equipment, often are called sales engineers or industrial salesworkers. In addition to having a thorough knowledge of their firms' products, they must be able to help prospective buyers with technical problems. For example, they may try to determine the proper materials and equipment for a firm's manufacturing process. They then present this information to company officials and try to negotiate a sale. Often, sales engineers work with the research-and-development departments of their own companies to devise ways to adapt products to a customer's specialized needs. Sales-

Manufacturer's salesworkers learn the advantages of new packaging materials.

workers who handle technical products sometimes train their customers' employees in the operation and maintenance of new equipment, and make frequent return visits to be certain that it is giving the desired service.

Although manufacturers' salesworkers spend most of their time visting prospective customers, they also do paperwork including reports on sales prospects or customers' credit ratings. In addition, they must plan their work schedules, draw up lists of prospects, make appointments, handle some correspondence, and study literature relating to their products.

Places of Employment

Over 42,000 people—10 percent of them women—were manufacturers' salesworkers in 1972. About 25,000 were sales engineers. Some work out of home offices, often located at manufacturing plants. The majority, however, work out of branch offices, usually in big cities near prospective customers.

More salesworkers are employed by companies that produce food products than by any other industry. Large numbers also work in the printing and publishing, chemicals, fabricated metal products, and electrical and other machinery industries The largest employers of sales engineers produce heavy machinery, transportation equipment, fabricated metal products, and professional and scientific instruments.

Training, Other Qualifications, and Advancement

Although high school graduates can be successful manufacturers' salesworkers, college graduates increasingly are preferred as trainees.

Manufacturers of nontechnical products often hire college graduates who have a degree in liberal arts or business administration. Some positions, however, require specialized training. Drug salesworkers usually need training at a college of pharmacy. Manufacturers of electrical equipment, heavy machinery, and some types of chemicals prefer to hire college-trained engineers or chemists. (Information on chemists, engineers, and other professionally-trained workers who may be employed as manufacturers' salesmen is given elsewhere in the *Handbook*.)

Beginning salesworkers take specialized training before they start on the job. Some companies, especially those that manufacture complex technical products, have formal training programs that last 2 years or longer. In some of these programs, trainees rotate among jobs in several departments of the plant and office to learn all phases of production, installation, and distribution of the product. Other trainees take formal class instruction at the plant, followed by on-the-job training in a branch office under the supervision of field sales managers.

A pleasant personality and appearance, and the ability to meet and get along well with many types of people are important. Because salesworkers may have to walk or stand for long periods or carry product samples, physical stamina is necessary. As in most selling jobs, arithmetic skills are an asset.

Sales representatives who have good sales records and leadership ability may advance to sales supervisors, branch managers, or district managers. Those having managerial skill eventually may advance to sales manager or other executive positions; many top executive jobs in in-

dustry are filled by people who started as salesworkers.

Because of frequent contact with business people in other firms, salesworkers often transfer to better jobs. Some go into business for themselves as manufacturers' agents selling similar products of several manufacturers. Other experienced salesworkers find opportunities in advertising and marketing research.

Employment Outlook

The number of manufacturers' salesworkers is expected to rise moderately through the mid-1980's as a result of general economic growth and the greater emphasis manufacturers will place on their sales activities. In addition to openings from growth, several thousand jobs will emerge annually as existing positions become vacant because of retirements or deaths. Still other vacancies will occur as salesworkers leave their jobs to enter other types of employment.

Among the factors expected to influence employment growth in the occupation are the expansion of markets for technical products and the resulting demand for trained salesworkers. In addition, the increased volume of business transacted with some customers—modern industrial complexes, chain stores, and large institutions of many kinds—will heighten competition among the manufacturers supplying these organizations and intensify the need for effective selling. Although they will fill thousands of sales jobs each year, manufacturers are expected to be selective in hiring. They will look for ambitious young people who are well trained and temperamentally suited for the job.

Earnings and Working Conditions

According to limited data, salaries for beginning salesworkers averaged about $9,000 a year in 1972, exclusive of commissions and bonuses. The highest starting salaries generally were paid by manufacturers of electrical and electronic equipment, construction materials, hardware and tools, and scientific and precision instruments.

Some manufacturing concerns pay experienced salesworkers a straight commission, based on their dollar amount of sales; others pay a fixed salary. The majority, however, use a combination plan of salary and commission, salary and bonus, or salary-commission and bonus. Commissions vary according to the salesworkers' efforts and ability, the commission rate, location of their sales territory, and the type of product sold. Bonus payments may depend on individual performance, that of all salesworkers in the group or district, or on the company's sales. Some firms pay annual bonuses; others offer bonuses as incentive payments on a quarterly or monthly basis. In 1972, many experienced salesworkers earned between $16,000 and $32,000 annually; some earned more. In general, the earnings of manufacturers' salesworkers are higher than the average for nonsupervisory workers in private industry, except farming.

Some manufacturers' salesworkers have large territories and do considerable traveling. Others usually work in the neighborhood of their "home base." When on business trips, salesworkers are reimbursed for expenses such as transportation and hotels. Some companies provide a car or pay a mileage allowance to salesworkers who use their own cars.

Manufacturers' salesworkers call at the time most convenient to customers and may have to travel at night or on weekends. Frequently, they spend evenings writing reports. However, some plan their schedules for time off when they want it. Most salesworkers who are not paid a straight commission receive 2 to 4 weeks' paid vacation, depending on their length of service. They usually share in company benefits, including life insurance, pensions, and hospital, surgical, and medical benefits.

Sources of Additional Information

For more information on the occupation of manufacturers' salesworker write:

Sales and Marketing Executives International, Student Education Division, 630 Third Ave., New York, N.Y. 10017.

REAL ESTATE SALESWORKERS AND BROKERS

(D.O.T. 250.358)

Nature of the Work

Real estate salesworkers and brokers represent property owners in selling or renting their properties. They are also called real estate agents or, if they are members of the National Association of Realtors, ® "Realtors®."

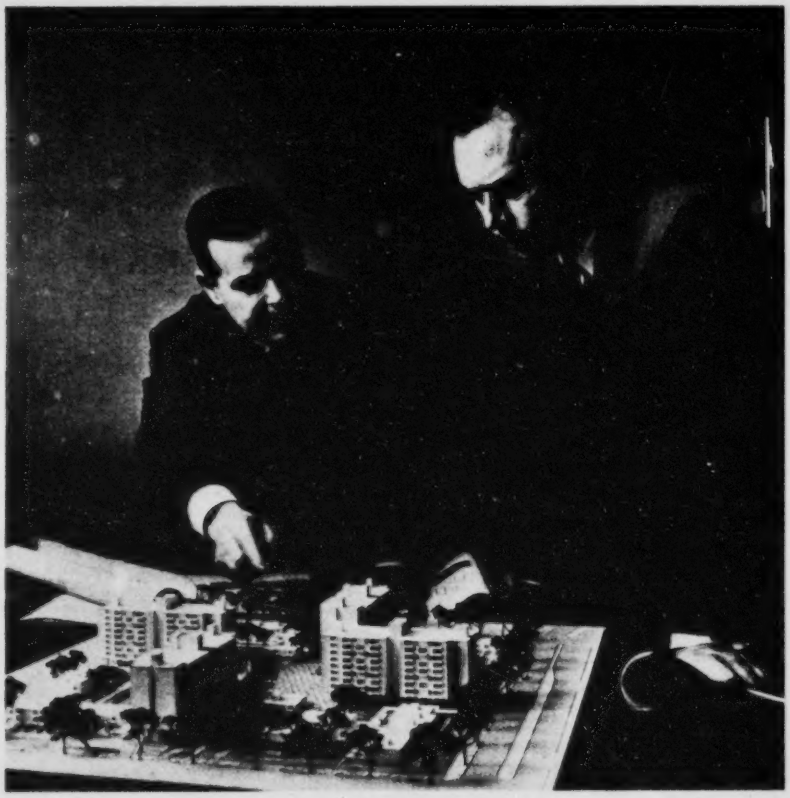
Brokers are independent businessmen who not only sell real estate, but also sometimes rent and manage properties, make appraisals, and develop new building projects. In closing sales, brokers usually make arrangements for loans to finance the purchases, for title searches, and for meetings between buyers and sellers, when details of the transaction are agreed upon and the new owners take possession. Brokers must also manage their own offices, advertising

properties, and handle other business operations. Some combine other work such as selling insurance or practicing law with their real estate business.

Salesworkers or agents work for brokers. They show and sell real estate, handle rental properties, and obtain "listings" (owner agreements to place properties for sale with the firm). Because obtaining listings is an important job duty, salesworkers may spend much time on the telephone exploring leads gathered from advertisements and personal contacts. They also answer inquiries about properties over the telephone.

A worker who sells real estate or handles rental properties often must leave the office to call on prospects and drive them to inspect properties for sale. When a number of houses are for sale in a new development, the agent may operate from a model home.

Most real estate salesworkers and brokers sell residential property. A few, usually in large firms, specialize in commercial, industrial or other types of real estate. Each specialty requires knowledge of the particular type of property. For example, selling or leasing business property requires an understanding of leasing practices, business trends, and location needs; those who sell or lease industrial properties must know about transportation, utilities and labor supply. To sell residential properties the agent must know the location of schools, churches, shopping facilities, and public transportation. Familiarity with tax rates and insurance is also important. The salesworker who is a broker's only employee may need some knowledge of all types of property.



Real estate salesworker points out features of condominium project.

Places of Employment

About 350,000 persons—60 percent of them men—were full-time real estate brokers and salesworkers in 1972. Many others sold real estate part time. The total number of men and women licensed to sell was about 1 million in 1972, according to the National Association of Real Estate License Law Officials.

Most real estate employees work for small business establishments; a few, in urban areas, work for firms with large staffs. Brokers generally are self-employed. Real estate is sold in all areas but employment is concentrated in large urban areas and in smaller but rapidly growing communities.

Training, Other Qualifications, and Advancement

Real estate salesworkers and brokers must be licensed in every State and in the District of Columbia. All States require prospective agents to pass written tests. The examination—more comprehensive for brokers than for salesworkers—includes questions on basic real estate transactions and on laws affecting the sale of property. In more than 60 percent of the States, candidates for a broker's license must have a specified amount of experience in selling real estate or the equivalent in related experience or education (generally 1 to 3 years). State licenses usually can be renewed annually without reexamination.

Employers prefer applicants with at least a high school education. High school courses in selling, architectural drawing, business law, eco-

nomics, and public speaking are helpful for those planning a career in real estate. Most agents have some college training and many are college graduates. College courses in real estate subjects as well as psychology, economics, finance, and business administration are an asset.

Young men and women interested in beginning jobs as real estate salesworkers often apply in their own communities, where their knowledge of local neighborhoods is an advantage. The beginner usually learns the practical aspects of the job under the direction of an experienced agent.

Many firms offer formal training programs for both beginners and experienced salesworkers. About 360 universities, colleges, and junior colleges offer courses in real estate. At some, a student can earn an associate's or bachelor's degree with a major in real estate; several offer advanced degrees. Many local real estate boards that are members of the National Association of Realtors ® sponsor courses covering the fundamentals and legal aspects of the field. Advanced courses in appraisal, mortgage financing, and property development and management also are available through various National Association affiliates.

Characteristics important for success in selling real estate include a pleasant personality, honesty, and a neat appearance. Maturity, tact, and enthusiasm for the job are required in order to motivate prospective customers in this highly competitive field. Agents also should have a good memory for names and faces and business details such as prices and zoning regulations.

Trained and experienced salesworkers can advance in many large firms to sales or general managers. Licensed brokers may open their own offices. Training and experience in estimating property value can lead to work as a real estate appraiser, and people familiar with operating and maintaining rental properties may specialize in property management. Those who gain general experience in real estate, and a thorough knowledge of business conditions and property values in their localities, may enter mortgage financing or real estate counseling.

Employment Outlook

Employment of real estate salesworkers and brokers is expected to rise moderately through the mid-1980's as more salesworkers are needed to serve a growing population. In addition to opportunities that result from growth, several thousand openings will occur each year as employees die, retire, or leave for other reasons. Replacement needs are relatively high in this occupation because agents are older, on the average, than workers in most other job fields; in addition, many beginners transfer to other work after a short time selling real estate.

Mature workers, including those transferring from other kinds of saleswork, are likely to find many job opportunities. The proportion of part-time real estate salesworkers may decline, as State licensing requirements change and agents need more specialized knowledge to handle real estate transactions.

The favorable outlook for employment in this field will stem partly from increased demand for new home purchases or rentals by the many young people born following World War II. Continued migration to metropolitan areas and urban renewal programs are among other factors which will contribute to a growing need for agents. Although this field is likely to remain highly competitive it should offer many career opportunities to people with an aptitude for selling.

Earnings and Working Conditions

Commissions on sales are the main source of earnings—very few real estate agents work for a salary. The rate of commission varies according to the type of property and its value; the percentage paid on the sale of farm and commercial properties or unimproved land usually is higher than that paid for selling a home.

Commissions may be divided among several employees of a real estate firm. The person who obtained the listing often receives a part when the property is sold; the broker who makes the sale either gets the rest of the commission, or else shares it with the agent who handles the transaction. Although an agent's share varies greatly from one firm to another, often it is about half of the total amount received by the firm.

Many full-time real estate agents earn between $12,000 and $20,000 a year, according to the limited data available. Beginners usually earn less. Experienced real estate salesworkers may earn $30,000 or more a year.

Income usually increases as an agent gains experience, but individual ability, economic conditions, and the type and location of the property also affect earnings. Salesworkers who are active in community organizations and local real estate boards can broaden their contacts and increase their earnings. A beginner's earnings often are irregular because a few weeks or even months may go by without a sale. Although some brokers allow a salesworker a drawing account against future earnings, this practice is not usual with new employees. The beginner, therefore, should have enough money to live on until commissions increase.

Brokers provide office space, but salesworkers generally furnish their own automobiles. Agents and

brokers often work in the evenings and during weekends to suit the convenience of customers. Some firms, especially the large ones, furnish group life, health, and accident insurance.

Sources of Additional Information

The real estate commission or board located in each State capital can supply details on licensing requirements for real estate salesworkers and brokers in the State. Most local real estate organizations also have this information. Many States can furnish manuals helpful to applicants who are preparing for the required written examinations.

More information about opportunites in real estate work, as well as a list of colleges and universities offering courses in this field, may be obtained by writing to:

National Association of Realtors ®
Department of Education, 155 East Superior St., Chicago, Ill. 60611.

RETAIL TRADE SALESWORKERS

(D.O.T. 260. through 290.877)

Nature of the Work

The success of any retail business depends largely on its salesworkers. Courteous and efficient service from behind the counter or on the sales floor does much to satisfy customers and build a store's reputation. Even though contact with customers is a part of all sales jobs, the duties, skills, and responsibilities of salesworkers are as different as the kinds of merchandise they sell.

In selling items such as furniture, electrical appliances, or clothing, the salesworker's primary job is to create an interest in the merchandise. The salesman or saleswoman may answer questions about the construction of an article, demonstrate its use, and show various models and colors. In some stores, special knowledge or skills may be needed to sell the merchandise carried. For example, in a pet shop, the salesworker should know about the care and feeding of animals. On the other hand, people who sell standardized articles, such as many items in hardware and drug stores, often do little more than take payments and wrap customer's purchases. (In supermarkets and some drugstores, cashiers wrap or bag purchases, receive payments, and make change. See statement elsewhere in the *Handbook* on Cashiers.)

In addition to selling, most retail salesworkers make out sales or charge slips, receive cash payments, and give change and receipts. They also handle returns and exchanges of merchandise and keep their work areas neat. In small stores, they may help order merchandise, stock shelves or racks, mark price tags, take inventory, and prepare displays. (Route salesmen, who sell bread, milk, and other products directly to customers on a regular route, are discussed under Driving Occupations elsewhere in the *Handbook*.)

Places of Employment

In 1972, about 2.8 million salesworkers—three-fifths of them

Retail salesworker describes fabric content to customer.

women—were employed in retail businesses. They worked in stores ranging from the small drug or grocery store that employs one part-time salesclerk to the giant department store that has hundreds of salesworkers. They worked also for door-to-door sales companies and mail-order houses. The largest employers of retail trade salesworkers are department stores and those selling general merchandise, food, and apparel and accessories. Men predominate in stores that sell furniture, household appliances, hardware, farm equipment, shoes, and lumber, and in automobile dealerships. (See statement on Automobile Salesworkers elsewhere in the *Handbook*.) Women outnumber men in department and general merchandise, variety, apparel and accessories, and in drugstores.

Although sales jobs are found in almost every community, most salesworkers are employed in large cities and populated suburban areas.

Training, Other Qualifications, and Advancement

Employers prefer high school graduates for sales jobs. Subjects such as salesmanship, commercial arithmetic, and home economics provide a good background for many selling positions. Some high schools have distributive education programs that offer courses in merchandising and principles of retail selling; many give students a chance to gain practical experience working part time in local stores. Such part-time selling experience may be helpful in getting a full-time job.

Young persons interested in sales jobs may apply to the personnel offices of large retail stores, where they are interviewed and sometimes given aptitude tests. Employers prefer those who enjoy working with people and have the tact to deal with different personalities. Among other desirable characteristics are an interest in sales work, a pleasant personality, a neat appearance, and the ability to communicate clearly. Also, prospective salesworkers should be healthy since they must stand for long periods. Arithmetic skills are an asset for those who calculate prices and make change.

In many small stores, an experienced employee or the proprietor instructs newly hired sales personnel in making out sales slips and operating the cash register. In larger stores, training programs are likely to be more formal, and to include specialized training in selling certain products.

Although large retail businesses often promote college graduates hired as trainees to executive jobs, retail selling remains one of the few fields in which able employees may advance regardless of education. Some salesworkers eventually become buyers, department managers, or store managers. Others, particularly in large stores, may advance to administrative work in areas such as personnel or advertising. Opportunities for advancement are limited in small stores where one person, often the owner, does most managerial work. Retail selling experience may be an asset in qualifying for sales work with wholesalers or manufacturers.

Employment Outlook

Employment of salesworkers in retail trade is expected to increase moderately through the mid-1980's, as the volume of sales rises and the trend for stores to remain open longer continues. Thousands of openings will occur each year because of employment growth and the need to replace salesworkers who retire or leave the occupation for other reasons. In addition to full-time jobs, there will be many opportunities for part-time workers, as well as for temporary workers during peak selling periods such as the Christmas season.

Sales employment will increase more slowly than the volume of sales as self-service—already the rule in most food stores—is extended to drug, variety, and other kinds of stores. On the other hand, rising income levels probably will increase the demand for some merchandise (such as electrical appliances and automobiles) that requires the salesworker to spend a good deal of time with each customer.

Earnings and Working Conditions

In 1972, salesworkers starting in routine jobs where they did little more than "wait on" customers generally earned $1.60 an hour (in many stores, the minimum wage required by law). In stores where selling is more important, starting salaries were sometimes higher. Salaries usually are lower in rural than in urban areas.

Often, experienced salesworkers, including those whose pay scales are determined by union contracts, earn $3 an hour or more. Many are paid a straight salary; in addition some receive commissions—that is, a percentage of the sales they make; still others are paid a straight commission alone. Earnings are likely to be highest in jobs that require special skill in dealing with customers, or technical knowledge of the merchandise sold. Among the highest paid are people who sell automobiles, major appliances, and furniture. On the average, retail trade salesworkers earn about as much as nonsupervisory workers in private industry, except farming.

Salesworkers in many retail stores can buy merchandise at a discount,

often from 10 to 25 percent below regular prices. This privilege sometimes is extended to the employee's family. Some stores, especially the large ones, pay all or part of the cost of such employee benefits as life insurance, retirement, hospitalization, and surgical and medical insurance.

Many full-time salesworkers have a 5-day, 40 hour week, although in some stores the standard workweek is longer. Because Saturday is a busy day in retailing, employees usually work that day and have another weekday off. Longer than normal hours may be scheduled before Christmas and during other peak periods, and employees who work overtime receive additional pay or an equal amount of time off during slack periods. Some, especially those employed by stores in suburban shopping centers regularly work one evening a week or more.

Part-time salesworkers generally work during the store's peak hours of business—daytime rush hours, evenings, and weekends.

Salesworkers in retail trade usually work in clean, well-lighted places and many stores are air-conditioned. Some jobs, however, require work outside the store. A kitchen equipment salesworker may visit prospective customers at their homes, for example, to help them plan renovations, and a used-car salesworker may spend much time at an outdoor lot.

Sources of Additional Information

Information about careers in retail sales is available from:

The National Retail Merchants Association, 100 W. 31st St., New York, N.Y. 10001.

Additional information on careers in retailing may be obtained from the personnel offices of local stores; from State merchants' associations; or from local unions of the Retail Clerks International Association.

Information on retailing courses given in high schools may be obtained from local Superintendents of Schools or from the State Supervisor of Distributive Education in the Department of Education at each State capital.

ROUTEMEN

(D.O.T. 292.358)

Nature of the Work

Routemen drive light trucks over assigned routes to sell and deliver goods or provide services. They are sometimes known as driver-salesmen or route-salesmen. They must, through their selling ability, increase sales to existing customers and obtain new business by canvassing potential customers within their territories.

Routemen's work varies according to the industries in which they are employed, the type of routes they have (retail or wholesale), and the companies employing them. Some specific examples, however, may describe in a general way what most routemen do.

On a typical day, laundry and drycleaning routemen begin by picking up cleaned garments at the processing plant and load their trucks, which are equipped with carrying racks. They deliver the cleaned garments to homes and there pick up soiled clothing. They mark the soiled articles so that they can be identified at the plant. Sometimes, they make notes of the type of stains to be removed or of special processes to be used, such as waterproofing. Each cleaned garment has an itemized bill attached so that drivers can collect the amounts of money due.

Although all routemen must be able to get along well with people, it is particularly important for the drycleaning and laundry routemen. Their reactions to complaints and requests for special services may be the difference between increasing business or losing customers. Periodically, they may call at homes along their routes to try to sell their company's services.

Wholesale bakery routemen deliver bread and other baked goods to grocery stores. Their trucks are loaded the night before or early in the morning, and they check to see whether the proper variety and quantity of products are aboard before starting on the route. Each of them generally stops at from 10 to 50 grocery stores, and at each stop, carries the orders of bread and other baked goods into the store and arranges them on the display racks. Together with the store owner or manager, bakery routemen check the merchandise delivered. They also credit the store for the value of the stale items left over from the previous delivery.

Bakery routemen prepare a list of products they plan to deliver the next day. These lists are estimates of the amount and variety of baked goods that will be sold by the grocery stores. From time to time, they call on grocers along the route who are not customers and try to get orders from them.

Vending machine routemen make certain the machines on their routes are stocked with merchandise and in good working order. At each location, they check the items remaining in machines and the money deposited in the cash boxes. They check vending machines to see that merchandise and change are dispensed properly, and make minor adjustments to machines that are broken. They clean machines, removing waste and accumulated dust, and replace stock.

Routemen keep records of the merchandise placed in each machine and the money removed. They may try to find new locations for vending machines by calling on stores, factories, and other businesses along their routes.

Places of Employment

About 190,000 routemen worked for a wide variety of businesses in 1972. Since most of them were employed by companies that distributed food products or provided personal services, they worked in small towns as well as in large cities. The greatest concentration of employment was in dairies, bakeries, food and beverage distributors, and drycleaning plants in the large cities.

Training, Other Qualifications, and Advancement

In addition to being good drivers, routemen must have sales ability. To get people to buy, they must have a thorough knowledge of the product or service they sell and a persuasive personality. Other important sales qualifications are a pleasant voice, ability to speak well, and a neat appearance. They also need self-confidence, initiative, and tact.

Routemen must be able to work without direct supervision, do simple arithmetic, and write legibly. In most States, a routeman is required to have a chauffeur's license, which is a commercial driving permit. Information regarding this license can be obtained from State Motor Vehicle Departments.

Most employers require their routemen to be high school graduates, preferably 25 years of age or older. Many large companies give applicants aptitude tests to determine whether they will make good salesmen and safe drivers. Routemen who handle a great deal of money may have to be bonded.

School-and-work programs in retail and wholesale merchandising are helpful to a person interested in entering this occupation. High school courses in salesmenship, public speaking, driver training, bookkeeping, and business arithmetic are helpful; almost immediately after high school graduation, valuable experience may be obtained as a sales clerk in a store or in some other type of selling job.

Another method of entering this occupation is to get a job as a *routeman helper* (D.O.T. 292.887). Employers occasionally hire persons 18 years of age or over to assist routemen. When an opening occurs, helpers may be promoted to routemen. Helpers, however, are not likely to be employed in the dairy or vending machine industries.

Most companies give their routemen on-the-job training which varies in length and thoroughness. Many large companies have classes in salesmanship. Some companies assign newly hired routemen for brief periods to jobs in the different departments of the plant, so that they can become familiar with processing operations and answer customers' questions intelligently.

Routemen may be promoted to route foreman or sales supervisor, but these jobs are relatively scarce. Advancement usually is limited to moving from a retail to a wholesale route, where earnings are generally higher. However, some routemen obtain better-paying sales jobs as a result of their experience in route selling.

Employment Outlook

The total number of routemen is expected to change little through the mid-1980's, although employment trends will differ for various types of routemen. For laundry and drycleaning retail routemen, for example, the outlook is for a decrease in employment as more people take their clothes to neighborhood plants or drive-up stores for quicker, more economical service. Even in declining fields, however, openings for new workers will arise as experienced routemen transfer to other fields of work, retire, or die.

Employment of wholesale bakery and dairy routemen probably will remain at about present levels or decline slightly. Since large supermarkets have been replacing small neighborhood stores, fewer routemen are required. Moreover, some manufacturers and wholesale food companies are replacing their routemen with salesmen who cover territories by automobile and truck-drivers who follow-up with the deliveries.

On the other hand, opportunities for employment as vending machine routemen will be excellent through the mid-1980's because of the expected rapid increase in the vending machine business. Some of the factors expected to stimulate the business are the development of new and improved machines and the greater use of automatic food service in industrial plants, schools, hospitals, and other high-traffic areas.

Earnings and Working Conditions

Most routemen receive a minimum salary plus a percent of the sales they make. Thus, earnings are determined largely by their selling ability and initiative. According to limited information available in 1972, retail routemen in the dairy and baking industries were guaranteed weekly wages of $110 to $180 plus commissions on sales. Many of these routemen earned more than $200 a week. Wholesale routemen usually earn more than retail routemen.

The number of hours worked by routemen varies. Some work only about 30 hours a week; others may work 60 hours or more depending upon whether the individual has a well-established route or is trying to build up a new one, whether he has a retail or a wholesale route, and how ambitious he is. The number of hours worked may be limited by a union contract, although many contracts specify merely the earliest hour that work may begin and the latest quitting time. The hours may also vary with the season. During the spring-cleaning season, for example, drycleaning routemen may work about 60 hours a week, but in winter they may work less than 30 hours.

Many companies require routemen to wear uniforms. Some employers pay for the uniforms and for keeping them clean.

Most routemen receive paid vacations, generally ranging from 1 to 4 weeks, depending upon length of service, and 6 paid holidays or more a year. Many employers also provide hospitalization and medical benefits; some have pension plans.

The routemen is on his own to a great extent. He does not work under strict supervision and, within certain broad limits, may decide how rapidly he will work and where and when he will have a lunch or rest period. On the other hand, a routeman has to make deliveries in bad weather and do a great deal of lifting, carrying, and walking. He also may have to work unusual hours. For example retail milk routemen generally start work in the very early morning.

Many routemen, particularly those delivering bakery and dairy products, are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) Some belong to the unions which represent the plant workers of their employers.

Sources of Additional Information

For details on routemen employment opportunities, contact local employers, such as bakeries and vending machine companies, or the local office of the State employment service.

SECURITIES SALESWORKERS

(D.O.T. 251.258)

Nature of the Work

When investors buy or sell stocks, bonds, or shares in mutual funds, they call on securities salesworkers to put the "market machinery" into operation. Both the individual who invests a few hundred dollars and the large institution with millions to invest need such services. Often these workers are called *registered representatives, account executives,* or *customers' brokers.*

In initiating buy or sell transactions, securities salesworkers relay orders through their firms' offices to the floor of a securities exchange. When the trade takes place in the over-the-counter market instead, they send the order to the firm's trading department. In either case, the salesworker promptly notifies the customer of the completed transaction and the final price.

In addition, they provide many related services for their customers. They may explain to new investors the meaning of stock market terms and trading practices. For more experienced investors who may have a variety of holdings, they may give suggestions and advice on the purchase or sale of a particular security. Some individuals may prefer long-term investments designed for either capital growth or income over the years; others might want to make short-term investments which seem likely to rise in price quickly. Securities salesworkers furnish information about the advantages and disadvantages of each type of investment based on each person's objectives. They also supply the latest stock and bond quotations on any security in which the investor is interested as well as information on the activities and financial positions of the corporations these securities represent.

Securities salesworkers may serve all types of customers or they may specialize in one type only, such as institutional investors. They also may specialize in handling only certain kinds of securities such as mutual funds. Some handle the sale of "new issues", such as corporation securities issued for plant expansion funds.

Beginning securities salesworkers spend much of their time searching for customers. Once they have established a clientele, however, they put more effort into servicing existing accounts and less into seeking new ones.

Places of Employment

About 220,000 persons—90 percent of them men—sold securities in 1972. Half worked full time in securities firms and in selling mutual funds. The rest include insurance salespersons offering securities to their customers, and part-time mutual fund representatives.

Securities salesworkers are employed by brokerage firms, investment bankers, mutual funds, and insurance companies in all parts of the country. Many of these firms are very small. Most salesworkers, however, work for a small number of large firms with main offices in big

Salesworkers discuss new stock offering.

cities (especially in New York) or for the nearly 7,000 branch offices in other areas.

Training, Other Qualifications, and Advancement

Because a securities salesworker must be well informed about economic conditions and trends, a college education is increasingly important, especially in the larger securities firms. This is not true, however, for part-time work selling mutual funds. Although employers seldom require specialized training, courses in business administration, economics, and finance are helpful.

Almost all States require persons who sell securities to be licensed. State licensing requirements may include passing an examination and furnishing a personal bond. In addition, salesworkers usually must register as representatives of their firms according to regulations of the securities exchanges where they do business or the National Association of Securities Dealers, Inc. (NASD). Before beginners can qualify as registered representatives, they must pass the Securities and Exchange Commission's (SEC's) General Securities Examination, or examinations prepared by the exchanges or the NASD. These tests measure the prospective representative's knowledge of the securities business. Character investigations also are required.

Most employers provide training to help salesworkers meet the requirements for registration. In member firms of all major exchanges the training period is at least six months. Trainees in large firms may receive classroom instruction in security analysis and effective speaking, take courses offered by schools of business and other institutions and associations, and undergo a period of on-the-job training. In small firms, and in mutual funds and insurance companies, training programs may be brief and informal. Beginners read assigned materials and watch other salesworkers transact business.

Many employers consider personality traits as important as academic training. Employers seek applicants who are well groomed, able to motivate people, and ambitious. Because maturity and the ability to work independently also are important, many employers prefer to hire those who have achieved success in other jobs. Successful sales or managerial experience is very helpful to an applicant.

The principal form of advancement for securities salesworkers is an increase in the number and the size of the accounts they handle. Although beginners usually service the accounts of individual investors, eventually they may handle very large accounts such as those of corporations. Some experienced salesworkers advance to positions as branch office managers, who supervise the work of other salesworkers while executing "buy" and "sell" orders for their own customers. A few representatives may become partners in their firms or do other administrative work.

Employment Outlook

The number of securities salesworkers is expected to grow moderately through the mid-1980's as securities investments continue to increase. In addition to jobs result-

ing from growth, many salesworkers will be needed to replace those who die, retire, or transfer to other jobs. Because of the competitive nature of the occupation, many leave their jobs, unable to establish a successful clientele.

Employment of securities salesworkers will expand as economic growth and rising personal incomes increase the funds available for investment. The activities of investment clubs, which enable small investors to make minimum monthly payments toward the purchase of securities, also will contribute to the demand for securities salesworkers. Growth in the number of institutional investors will be particularly strong as more people purchase insurance; participate in pension plans; contribute to the endowment funds of colleges and other nonprofit institutions; and deposit their savings in banks. In addition, more workers will be needed to sell securities issued by new and expanding corporations and by State and local governments financing public improvements.

Earnings and Working Conditions

Trainees usually are paid a salary until they meet licensing and registration requirements. After registration, a few firms continue to pay a salary until the new representative's commissions increase to a stated amount. The salaries paid during training usually range from $500 to $700 a month; those working for large securities firms may receive as much as $850 a month.

After candidates are licensed and registered, their earnings depend on commissions from the sale and purchase of securities for customers. Commission earnings are likely to be high when there is much buying and selling, and lower when there is a slump in market activity. Most firms provide salesworkers with a steady income by paying a "draw against commission"—that is, a minimum salary based on the commissions which they can be expected to earn. A few firms pay salesworkers only salary and bonuses, that usually are determined by the volume of company business.

Earnings of full-time, experienced securities salesworkers averaged $21,000 a year in 1972, according to the limited data available. Some earned more than $30,000 a year. Full-time securities salesworkers earn about three times as much as average earnings for nonsupervisory workers in private industry, except farming.

Securities salesworkers usually work in offices where there is much activity. In large offices, for example, rows of salesworkers sit at desks in front of "quote boards" which continually flash information on the prices of securities transactions.

Although established salesworkers usually work the same hours as others in the business community, beginners who are seeking customers may work longer. Some salesworkers accommodate customers by meeting with them in the evenings or on weekends.

Sources of Additional Information

Further information concerning a career as a securities salesworker may be obtained from the personnel departments of individual securities firms.

WHOLESALE TRADE SALESWORKERS

(D.O.T. 260. through 289.458)

Nature of the Work

Salesworkers in wholesale trade play an important role in moving goods from the factory to the consumer. Each salesworker may represent a wholesaler that distributes hundreds of similar products. A wholesale drug company, for example, may stock its warehouse with many brands of drugs, soap, and cosmetics to supply stores that sell directly to the consumer. In much the same way, a wholesale building materials distributor sells hardware and construction materials to builders who would otherwise have to deal with many manufacturers.

At regular intervals, salesworkers visit buyers for retail, industrial, and commercial firms, as well as buyers for institutions such as schools and hospitals. They show samples, pictures, or catalogs that list the items which their company stocks. Salesworkers seldom urge customers to purchase any particular product, since they handle a large number of items. Instead, they offer prompt, dependable service so buyers will become regular customers.

Wholesale salesworkers perform many important services, such as checking the store's stock and ordering items that will be needed before the next visit. Some wholesale salesworkers help store personnel improve and update systems for ordering and inventory. In addition, they often advise retailers about advertising, pricing, and arranging window and counter displays. A salesworker who handles specialized products, such as air-conditioning equipment, may give technical assistance on installation and maintenance.

Wholesale trade salesworker checks drug store inventory before writing order for new shipment.

Salesworkers do some record-keeping and attend to other details. They must forward orders to their wholesale houses, prepare reports and expense accounts, plan work schedules, draw up lists of prospects, make appointments, and study literature relating to their products. Some collect money for their companies.

Places of Employment

About 690,000 people, mostly men, were wholesale salesworkers in 1972. Wholesale houses usually are located in cities, but salesworkers may be assigned territories in any part of the country. Their territory may cover a small section of a city having many retail stores and industrial users; in less populated regions it may cover half a State or more.

Companies that sell food products are leading employers of wholesale salesworkers. Other large employers are wholesalers dealing in drugs, dry goods and apparel, motor vehicle equipment, and electrical appliances. Firms selling machinery and building materials to industrial and business users employ many salesworkers as well.

Training, Other Qualifications, and Advancement

In hiring trainees for sales work, most wholesalers seek people who are neat, outgoing, self-confident, enthusiastic about the job, and understanding of human nature. As in most selling jobs, skills in arithmetic and a good memory are assets. High school graduation is the usual educational requirement, although many companies that sell technical and scientific products prefer applicants who have specialized training beyond high school. In some cases, an engineering degree is required.

Newly hired salesworkers who are college graduates usually participate in formal training programs that combine classroom instruction and short rotations in various nonselling jobs. By working a few weeks in the wholesaler's warehouse, a new employee may gain first-hand experience in writing orders, pricing, and locating stock. Through cooperative programs, some college students combine academic study and on-the-job experience. Graduates having this background often begin outside saleswork without further training.

High school graduates may begin a career with a wholesale firm in a nonselling job or be hired as a sales trainee. In either case, beginners usually work in several kinds of nonselling jobs before being assigned to sales. They may start in the stockroom or shipping department to become familiar with the thousands of items the wholesaler carries. Later they may learn the prices of articles and discount rates for goods sold in quantities. Next, they are likely to work on "inside" sales, and write telephone orders. Later, as they accompany an experienced salesworker on calls, trainees come to know some of the firm's customers. The time spent in these initial jobs varies among companies, but usually it takes 2 years or longer to prepare trainees for outside selling.

Experienced salesworkers who have leadership qualities and sales ability may advance to supervisor, sales manager, or other executive positions.

Employment Outlook

Employment opportunities for salesworkers in wholesale trade are expected to be good through the mid-1980's. In addition to new positions created by growth, thousands of openings will occur each year as salesworkers retire, die, or leave the occupation for other reasons.

The number of wholesale salesworkers is expected to rise moderately as economic growth and increases in population spur continued business expansion. Although the computer will relieve workers of some duties, wholesale salesworkers will spend more time giving special services to customers.

As chain stores and other large firms centralize purchasing activities, the value of the sales made to individual customers becomes larger and competition for sales correspondingly greater. Wholesalers can be expected to meet this competition by emphasizing sales activities.

Earnings and Working Conditions

According to limited information, most beginning salesworkers earned

around $9,000 a year in 1972. Experienced salesworkers averaged $15,000 annually, and many earned considerably more. In general, wholesale salesworkers' earnings are much higher than those of nonsupervisory workers in private industry, except farming.

Most employers pay a salary plus a percentage commission on sales; others pay a straight commission. Although most wholesale salesworkers have steady, year-round work, sales (and commissions) vary because demand for some products—for example, air conditioning—is greater during certain seasons. To provide salesworkers with a steady income, many companies pay experienced personnel a "draw" against annual commissions. Most companies furnish cars or allowances for cars and reimbursements for certain expenses on the road.

Salesworkers often have long, irregular work hours. Although they call on customers during business hours, they may travel at night or on weekends to meet their schedule. However, most salesworkers seldom are away from home for more than a few days at a time. They may spend evenings writing reports and orders, may carry heavy catalogs and sample cases, and may be on their feet for long periods.

Depending on length of service, most salesworkers have a 2-to-4-week paid vacation. Many are covered by company benefits, including health and life insurance and retirement pensions.

Sources of Additional Information

Information on jobs in wholesale selling may be obtained directly from local wholesale houses or from associations of wholesalers in many of the larger cities. If no local association is available, write to:

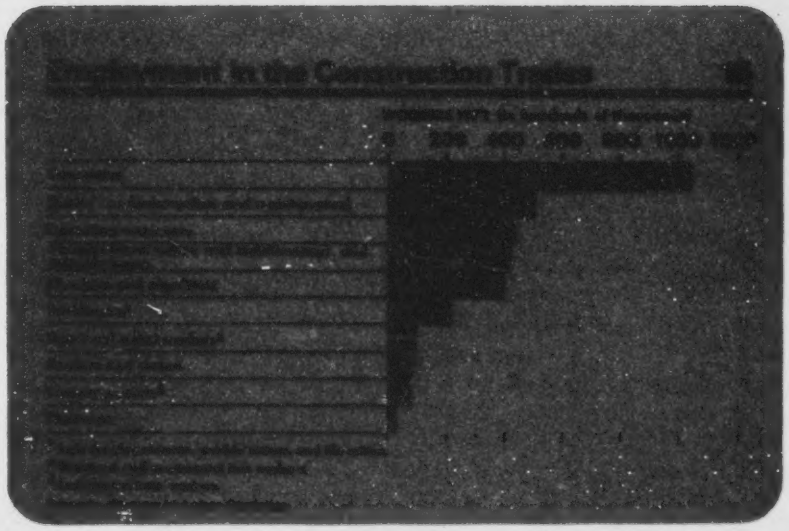
National Association of Wholesaler-Distributers, 1725 K St. NW., Washington, D.C. 20006.

Sales and Marketing Executives International, Student Education Division, 630 Third Ave., New York, N.Y. 10017.

CONSTRUCTION OCCUPATIONS

Construction craftsmen represent the largest group of skilled workers in the Nation's labor force. Altogether, there were 3.3 million of these craftsmen employed in 1972—about 3 out of every 10 skilled workers.

The more than two dozen skilled construction trades vary greatly in size. Several major trades—carpenter, painter, plumber, pipefitter, bricklayer, operating engineer, and electrician—each had more than a hundred thousand workers. (See chart 15.) Carpenters alone numbered 1,045,000—nearly one-third of all construction craftsmen. By contrast, only a few thousand each were employed in trades such as marble setter, terrazzo worker, and stonemason.



What are the Construction Trades?

Workers in the construction trades build, repair, and modernize homes and all kinds of buildings. They also work on a variety of other structures, including highways, airports, and missile launching pads.

The construction trades consist primarily of craftsmen who have a high level of skill and a sound knowledge of their trade. They often are assisted by apprentices, tenders, and laborers.

The work of construction tradesmen may be divided into three categories: structural, finishing, and mechanical. Some craftsmen—for example, carpenters—do both finishing and structural work. In general, each trade falls in one of the following categories:

Trades mainly concerned with structural work: Carpenter, operating engineer (construction machinery operator), bricklayer, structural-iron worker, ornamental-iron worker, cement mason, reinforcing-iron worker (rodman), rigger and machine mover, stonemason, and boilermaker.

Trades mainly concerned with finishing work: Lather, plasterer, marble setter, terrazzo worker, painter, paperhanger, glazier, roofer, floor covering installer, and asbestos worker.

Trades mainly concerned with mechanical work: Plumber, pipefitter, construction electrician, sheetmetal worker, elevator constructor, and millwright.

Most construction trades occupations are described individually later in this chapter. Boilermakers and millwrights are described elsewhere in the *Handbook*. These descriptions are necessarily brief and incomplete, and do not apply fully to all localities.

Also, they are not statements or recommendations concerning the work jurisdiction of these trades, and are inappropriate for use in jurisdictional negotiations or the settlement of jurisdictional questions.

Where Construction Tradesmen Are Employed

Construction tradesmen are employed mostly by contractors in the

construction industry. There are several hundred thousand contractors, and most are small—generally employing fewer than 10 craftsmen. Some large contractors, however, employ thousands. Large numbers of construction tradesmen are employed in other industries, such as mining and manufacturing, mainly to do maintenance and repair work. Chemical manufacturers, for example, need plumbers and pipefitters to maintain the complex pipe networks in their processing plants. Government agencies employ construction tradesmen to maintain highways, buildings, and sanitation systems.

Many construction trades workers are self-employed and work directly for property owners on small jobs. Self-employment is most common in carpentry and painting, but it also is found in other trades.

Employment of construction tradesmen is distributed geographically in much the same way as the Nation's population. Thus, the highest concentration generally is in industrialized and highly populated areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend formal apprentice training as the best way to acquire the all-round skills in the construction trades. Apprenticeship is a prescribed period of on-the-job training, supplemented by related classroom instruction which is designed to familiarize apprentices with the materials, tools, and principles of their trade. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Many construction tradesmen acquire their skills informally, by working as laborers and helpers and observing experienced craftsmen. Some acquire skills by attending vocational or trade schools or by taking correspondence school courses.

Apprentices in the construction trades generally must be 18 to 25 years old, and in good physical condition. The maximum age limit may be waived for veterans or others who have experience or special qualifications. A high school education, or its equivalent, including courses in mathematics and the sciences, is desirable and is required in a few trades. Often, applicants are given tests to determine their aptitude. For some trades, manual dexterity, mechanical aptitude, and an eye for proper alignment of materials are important.

The formal apprenticeship agreement generally calls for a training period of from 2 to 5 years and 144 hours or more a year of related classroom instruction. The journeymen and the foreman explain to the apprentice how the work is done and show how different operations are performed and the way different tools are used. Ordinarily, most instruction is given by a particular journeyman to whom the apprentice is assigned.

Classroom instruction varies among the construction trades, but usually includes courses such as history of the trade, characteristics of materials, shop mathematics, and basic principles of engineering. It also includes sketching, elementary drafting, and interpretation of drawings; safety practices; and special trade theory such as color harmony for painters and elementary sanitation for plumbers. This instruction seldom is offered in small communities where there may be only a few apprentices. In these communities, apprentices receive instruction through courses offered in the local high school or by visiting instructors who are generally furnished by the State.

The registered apprenticeship agreements also stipulate the length of time the apprentice is to work in each major operation of the trade, as well as the rate of pay. The apprentice is paid a rate that usually starts at 50 percent of the journeyman's pay. The apprentice's rate increases at 6-month or 1-year intervals until a rate of about 90 percent of the journeyman's pay is reached in the final months of training. Often, advanced apprenticeship standing and pay are given to apprentices who have acquired trade skills in the Armed Forces or through trade school instruction.

In most communities, the apprenticeship programs are supervised by joint apprenticeship committees composed of representatives of the local employers or employer groups and the local union. The committee determines the need for apprentices in the locality and establishes minimum standards of education, experience, and training. Whenever an employer cannot provide all-round instruction or relatively continuous employment, the committee transfers the apprentice to another employer. Where specialization by contractors is extensive—for instance, in electrical work—customarily the committee rotates apprentices among several contractors at intervals of about 6 months.

In areas where these committees have not been established, the apprenticeship agreement is solely between the apprentice and the employer or employer group. Many tradesmen have received valuable training under these programs, but they have some disadvantages. No committee is available to supervise the training offered and settle differences over the terms and conditions of training. What the apprentice learns depends largely on the employer's business prospects and policies. If the employer lacks con-

tinuous work or does only a restricted type of work, the apprentice cannot develop all-round skills.

In early 1973, about 155,000 trainees were registered in construction trades apprentice programs. Additional apprentices receive their training in unregistered programs.

In many localities, craftsmen—most commonly construction electricians and plumbers—are required to have a journeyman's license to work at their trade. To qualify for these licenses, they must pass an examination to demonstrate a broad knowledge of the job and of State and local regulations.

Construction trades craftsmen may advance in a number of ways. For example, journeymen may become foremen. In most localities, small jobs are run by "working foremen" who work at the trade along with members of their crews. On larger jobs, the foremen do only supervisory work. Craftsmen also can become estimators for contractors. In these jobs, they estimate material requirements and labor costs to enable the contractor to bid on a particular construction project. Some craftsmen advance to jobs as superintendents on large projects. Others become instructors in trade and vocational schools or salesmen for building supply companies. Many craftsmen have become contractors in the homebuilding field.

Starting a small contract construction business is easier than starting a small business in many other industries. Only moderate financial investment is needed because liberal credit arrangements make it easy to buy materials, and conducting a fairly substantial business from the proprietor's home is possible. However, the contract construction field is highly competitive, and the rate of business failure is especially high among small contractors.

Employment Outlook

Employment in the construction trades is expected to increase rapidly through the mid-1980's. In addition to employment growth, more than 100,000 job openings will result each year from the need to replace experienced workers who transfer to other fields of work, retire, or die.

The rapid growth in employment is expected to result primarily from a rapid rise in construction activity. The anticipated large increases in population and households, and the relatively low-level of housing construction in the late 1960's, are expected to create strong pressure for new housing. Among other factors that will stimulate construction activity are a rise in spending for new industrial plants and equipment and higher levels of personal and corporate income. Also, there will be a growing demand for alteration and modernization work on existing structures, as well as for maintenance and repair work on the expanding highway systems and on the additional numbers of dams, bridges, and similar projects.

The increase in employment is not expected to be as great as the expansion in construction activity. Continued technological developments in construction methods, tools and equipment, and materials will raise output per construction worker. One important development is the growing use of prefabricated units at the job site. For example, preassembled outside walls and partitions can be lifted into place in one operation. An outgrowth of prefabrication is "module building" in which units, including complete rooms, are assembled at a factory.

Also expected to increase workers' efficiency are technological advances in construction tools and equipment. Items formerly unloaded and moved to the construction site by hand, such as concrete and brick, now are being moved by forklift trucks, motorized wheelbarrows, and conveyor belts. The size and speed of cranes and other construction machines have increased considerably. New machines that reduce labor requirements also are being developed. Concrete paving machines that perform the work formerly done by four separate machines are an example.

The rates of employment growth will differ among the various construction trades. Employment growth is expected to be most rapid for construction electricians, cement masons, glaziers, operating engineers, and plumbers and pipefitters. Among the trades that will have a slower growth rate are stonemasons and marble setters.

Earnings and Working Conditions

Hourly wage rates for construction tradesmen are among the highest for skilled workers. However, because construction work is seasonal and time also is lost for other reasons, annual earnings are not as high as the hourly rates of pay would indicate. Union minimum hourly averages for journeymen in 68 large cities in 1972 are shown in the accompanying tabulation.

A substantial proportion of construction trades workers are included in health, insurance, and pension programs negotiated between unions and employers and financed entirely by employer contributions.

Construction work frequently requires prolonged standing, bending, stooping, and working in cramped quarters. Exposure to weather is common as much of the work is done outdoors or in partially enclosed structures. Many people prefer construction work because it permits them to be outdoors.

	Hourly rate
All building trades	$7.27
Journeymen	7.69
Electricians (inside wiremen)	8.19
Plumbers	8.15
Pipefitters	8.14
Sheet-metal workers	8.09
Asbestos workers	8.01
Elevator constructors	8.00
Bricklayers	7.99
Stonemasons	7.87
Structural-iron workers	7.79
Rodmen	7.73
Lathers	7.67
Terrazzo workers	7.52
Marble setters	7.50
Plasterers	7.45
Carpenters	7.41
Roofers, composition	7.37
Cement masons (finishers)	7.24
Glaziers	7.23
Roofers, slate and tile	7.22
Tilesetters	7.16
Paperhangers	7.09
Painters	7.06

Average hourly union scales for construction helpers and laborers are listed in the following tabulation:

	Hourly rate
Helpers and laborers	$5.68
Terrazzo workers' helpers	6.46
Marble setters' helpers	6.35
Tilesetters' helpers	6.25
Bricklayers' tenders	6.06
Plasterers' laborers	5.81
Plumbers' laborers	5.79
Elevator constructors' helpers	5.64
Building laborers	5.57
Composition roofers' helpers	4.62

Construction work generally is more dangerous than work in manufacturing, but the risk of injury is lessened considerably when safe work practices are followed.

Forty hours was the standard workweek for a vast majority of union construction workers in 1972. Time and one-half generally was paid for hours worked beyond the standard workday of 8 hours. Time and one-half or double-time rates were usually paid for work on Saturdays and Sundays or holidays.

The construction trades offer especially good opportunities for young people who are not planning to go to college, but who are willing to spend several years in learning a skilled occupation. Construction tradesmen can find job opportunities in all parts of the country. Their hourly wage rates generally are much higher than those of most other manual workers. As previously noted, construction tradesmen with business ability have greater opportunities to open their own businesses than workers in most other skilled occupations.

A large proportion of construction workers are members of trade unions affiliated with the Building and Construction Trades Department of the American Federation of Labor and Congress of Industrial Organizations.

Sources of Additional Information

Information about opportunities for apprenticeship or other training can be obtained from local construction firms and employer associations, locals of the office of the State apprenticeship agency, or the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. Many apprenticeship programs are supervised by local union-management committees. In these instances, an apprentice applicant may apply directly to the coordinator of the committee. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

For additional information on jobs in the construction trades, write to the organizations listed below:

American Federation of Labor and Congress of Industrial Organizations, Building and Construction Trades Department, 815 16th St. NW., Washington, D.C. 20006.

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

National Association of Home Builders, 1625 L St. NW., Washington, D.C. 20036.

For the names of labor organizations and trade associations concerned with specific trades, see the discussions of individual building trades later in this chapter.

ASBESTOS AND INSULATION WORKERS

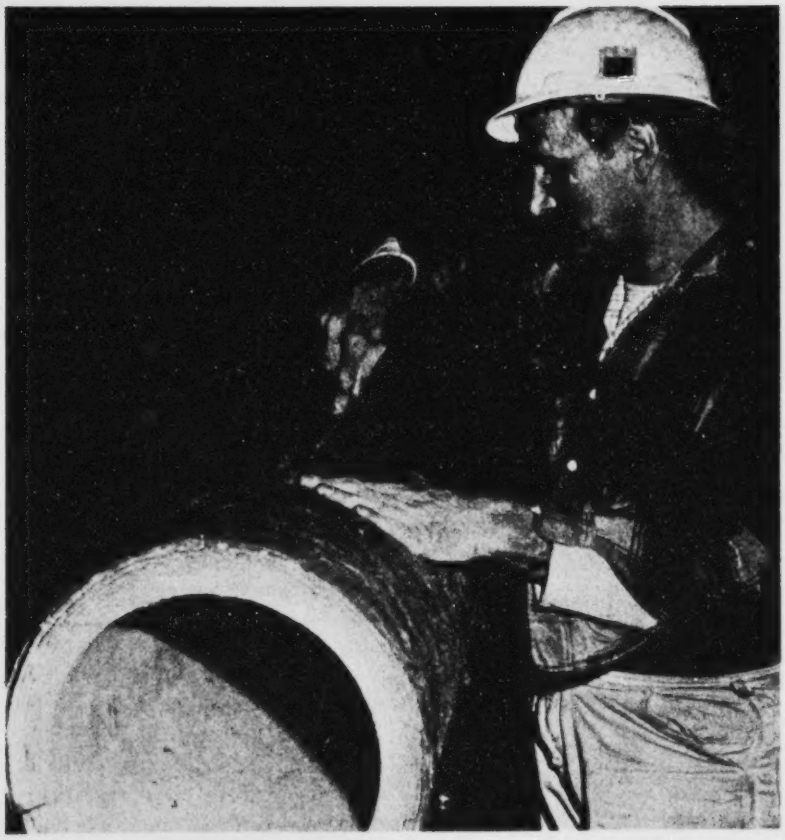
(D.O.T. 863.381, .781, and .884)

Nature of the Work

Asbestos and insulation workers cover pipes, boilers, furnaces, and related equipment with asbestos and other insulating materials. These materials retain heat or cold, absorb sound, and can act as a vapor barrier. Insulated walls and ceilings in a home, for example, reduce fuel costs by preventing loss of heat during the cold months.

Insulating materials are installed by pasting, wiring, taping, stud-welding, spraying, or plastering. When covering pipework, asbestos workers cut either block or preformed insulation to the required size and shape, and then wrap this material around the pipe. They secure the insulating material by using wire bands, or by covering it further with tar paper, cloth, or canvas, sewed or stapled into place. Care is required to cover joints completely.

When covering flat surfaces, asbestos workers spotweld or screw wire fasteners to the surface and install the insulating material. They coat joints with an asbestos cement and wrap them with tape for a tight



Asbestos worker cuts insulating material.

seal. They sometimes spray or plaster insulating material to a wire mesh placed on the surface to be covered. The wire mesh provides a surface for adhesion as well as structural strength for the insulation. A final coat is applied and finished for a smooth appearance.

Asbestos and insulation workers use common handtools—trowels, brushes, scissors, sewing equipment, and stud-welding guns. Powersaws, as well as handtools, are used to cut and fit insulating materials.

Places of Employment

About 30,000 asbestos and insulation workers were employed in 1972, most of whom worked for insulation contractors. Others were employed to alter and maintain insulated pipework in chemical factories, petroleum refineries, atomic energy installations, and similar plants which have extensive steam installations for power, heating, and cooling. Some large firms which have cold storage facilities also employ these workers for maintenance and repair.

Training, Other Qualifications, and Advancement

Most asbestos and insulation workers learn their trade through a 4-year "improvership" program, similar in many respects to apprenticeship programs in other building trades. The improvership program consists of a specified period of on-the-job training in which the trainee learns all aspects of the trade.

Applicants for improvership programs generally must be 18 to 30 years old and in good physical condition. Trainee wage rates start at about 50 percent of the journeyman's rate and increase periodically until the journeyman's rate is reached at the completion of the program. Trainees are required to pass an examination that demonstrates their knowledge of the trade.

A skilled asbestos and insulation worker may advance to foreman, shop superintendent, or estimator, or he may open his own insulation contracting business.

Employment Outlook

Employment of asbestos and insulation workers is expected to increase rapidly through the mid-1980's. Several hundred annual openings are expected because of an increase in construction activity and the need to replace those journeymen who transfer to other occupations, retire or die. Employment growth will result from a rise in commercial and industrial building. (See discussion in construction occupations introduction.) The increasing use of pipe systems in manufacturing processes also will expand job opportunities for these workers.

Earnings and Working Conditions

Union minimum wage rates for asbestos and insulation workers in 68 large cities averaged $8.01 an hour in 1972, compared with $7.69 an hour for all building trades journeymen. Minimum rates for asbestos and insulation workers in 14 of these cities, selected to show how wages differ

among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rate*
Birmingham	$ 6.58
Buffalo	8.39
Cleveland	10.31
Columbus	9.72
Denver	7.45
Indianapolis	8.40
Memphis	7.43
Minneapolis-St. Paul	8.17
Newark	7.49
Norfolk	7.30
Pittsburgh	8.72
San Diego	8.10
Springfield	8.05
Tampa	6.40

Asbestos and insulation workers spend most of the workday on their feet, either standing, bending, stooping, or squatting. Sometimes they work from ladders or in tight spaces when covering pipes and ducts. Removing old insulation before installing new materials is often dusty and dirty.

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers.

Sources of Additional Information

For information about asbestos and insulation workers' improvership programs or other work opportunities in this trade, contact a local asbestos contractor or a local of the International Association of Heat and Frost Insulators and Asbestos Workers. In addition, the local office of the State employment service may provide information about work and training opportunities, including training programs operated under the Manpower Development and Training Act.

BRICKLAYERS

(D.O.T. 861.381, .781, and .884)

Nature of the Work

Bricklayers (or brickmasons) build walls, partitions, fireplaces, and other structures with brick, cinder block, and other masonry materials. They also install fire brick linings in industrial furnaces.

In putting up a brick wall, bricklayers first build the corners at each end of the wall, using plumb lines and a mason's level. A line is then stretched from corner to corner as a guide for each course or layer of brick. Bricklayers spread a bed of mortar (cement mixture) with a trowel, place the brick on the mortar bed, and then tap it into place. When necessary, they cut bricks to fit around windows, doors, and other openings. Mortar joints are finished with jointing tools to leave a neat and uniform appearance.

Bricklayers use handtools primarily, including trowels, brickhammers, levels, chisels, and rules. Powersaws are often used for cutting and fitting bricks and other masonry materials.

Bricklayers are assisted by hod carriers, or helpers, who supply them with bricks and other materials, mix mortar, and set up and move scaffolding. (Detailed occupational descriptions for construction laborers and hod carriers appear elsewhere in the *Handbook*.)

Places of Employment

Bricklayers—who numbered about 180,000 in 1972—are employed mainly in building new homes, schools, hospitals, and other structures. A few specialize in sewer construction, building manholes and catch basins, while others build large chimneys and smokestacks for factories and electric power plants. In addition, many bricklayers alter,

maintain, and repair buildings. They also work in factories that make glass or steel, where furnaces and kilns require fire brick linings.

Bricklayers can find jobs throughout the country, but employment is concentrated in heavily populated areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of an apprenticeship program as the best way to learn bricklaying. Many workers, however, pick up the trade informally by starting as helpers or hod carriers, and by observing and learning from experienced bricklayers.

Apprentice applicants generally must be 17 to 24 years old, but this requirement may be waived for veterans. A high school education or its equivalent is desirable. The ability to solve arithmetic problems quickly and accurately is an asset.

The apprenticeship program generally consists of 3 years of on-the-job training, in addition to 144 hours of classroom instruction each year in subjects such as blueprint reading, layout work, measurement and sketches, and welding. Some programs qualify the apprentice trainee as a bricklayer-welder. Apprentices also learn the relationship between bricklaying and other building trades. In some areas apprenticeship includes brief pre-job instruction, usually at a vocational school, to give apprentices a basic knowledge of the tools and materials of the trade and prepare them for the start of their on-the-job training.

Hourly wage rates for apprentices generally start at 50 percent of the journeyman bricklayer's rate, and increase periodically until 95 percent of the journeyman's rate is reached during the last period of apprenticeship.

Bricklayers must have an eye for straight lines and proportions. Good physical condition and manual dexterity also are important.

Bricklayers may advance to jobs as foremen. They also may become estimators for bricklaying contractors. Estimators compute material requirements and labor costs. Some journeymen become bricklaying superintendents on large construction projects, while others may start their own contracting businesses.

Employment Outlook

Employment of bricklayers is expected to increase moderately through the mid-1980's. In addition to the job openings that result from employment growth, many openings will arise as journeymen bricklayers retire, die, or transfer to other occupations.

Much of the expected growth in this trade will result from the anticipated large increase in construction activity. The demand for bricklayers also will be favorably affected by the growing use of ornamental brickwork for structures such as lobbies and foyers. In addition, the use of brick load-bearing walls is growing, particularly in apartment construction. Brick panels, laid in factories by bricklayers, are being introduced and will provide additional jobs for bricklayers.

Earnings and Working Conditions

Union minimum wage rates for bricklayers in 68 large cities averaged $7.99 an hour in 1972, compared with $7.69 an hour for all building trades journeymen. Minimum rates for bricklayers in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rate*
Atlanta	$ 7.80
Boston	8.45
Charlotte	5.85
Chicago	8.90
Cleveland	8.86
Detroit	8.44
Indianapolis	8.55
Memphis	7.55
Milwaukee	7.93
Newark	9.00
Sacramento	8.20
Seattle	7.65
Tampa	7.05
Topeka	7.45

Although hourly rates for bricklayers are relatively high, time lost because of poor weather and occasional unemployment between jobs make annual earnings less than the hourly rates would imply.

Bricklaying is sometimes strenuous. It involves stooping to pick up materials, moderately heavy lifting, and prolonged standing. Most of the work is done outdoors.

A large proportion of bricklayers are members of the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For details about apprenticeships or other work opportunities in this trade, contact local bricklaying contractors; a local of the Bricklayers, Masons and Plasterers' International Union of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may provide details about the Manpower Development and Training Act, apprenticeship, and other training opportunities. Some local employment service offices provide services such as screening applicants and giving aptitude tests.

General information about the trade is available from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

Brick Institute of America, 1750 Old Meadow Road, McLean, Va. 22101.

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

CARPENTERS

(D.O.T. 860.281 through .781)

Nature of the Work

Carpenters, the largest group of building trades workers, are employed in almost every type of construction activity. They erect the wood framework in buildings and install windows, doors, paneling, cabinets, and other items. They also build stairs, lay hardwood floors, and install soft floor coverings such as linoleum and asphalt tile.

Carpenters install heavy timbers used to build docks, railroad trestles, and similar structures. They build the forms needed to pour concrete decks, columns, piers, and retaining walls used in construction of bridges, buildings, and other structures. They erect scaffolding and temporary buildings at the construction site.

Because of the variety of work in the trade, some carpenters specialize in a particular type of carpentry. For example, some build forms to receive concrete; others install millwork and finish hardware (trimming), lay and finish hardwood floors, or build stairs. Specialization is more common in large cities; in small communities, carpenters often perform a wider range of tasks. In rural areas, carpenters may do the work of other craftsmen, particularly painting, glazing, or roofing. Carpenters generally stay in a particular field of construction, such as home, bridge, or highway construction, or in industrial maintenance.

Carpenters use nails, bolts, wood screws, or glue to fasten lumber, plywood, and other materials. They use handtools such as hammers, saws, and chisels, and power tools such as electric saws, drills, and powder-actuated fastening devices.

Places of Employment

About 1,045,000 carpenters were employed in 1972. Most carpenters are employed by contractors and homebuilders to construct new buildings and other structures. A substantial number, however, alter, remodel, or repair buildings. Some carpenters alternate between wage employment for contractors and self-employment on small jobs. Others work for government agencies, utility companies, or manufacturing plants. A large number of carpenters maintain and repair facilities within factories, hotels, office buildings, and other large establishments. Still others are employed in shipbuilding, in mining, and in the production of many kinds of display materials such as signs and billboards.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn carpentry. A substantial number of workers in this trade, however, acquire some carpentry skills informally (for example, by working on a farm). Many also gain some knowledge of the trade by taking correspondence or trade school courses.

Apprenticeship applicants generally must be 17 to 27 years old, and a high school education or its equivalent is desirable. Good physical condition, a good sense of balance, and lack of fear of working on high structures are important assets. Apprentices should also have manual dexterity and the ability to solve arithmetic problems quickly and accurately. In addition, they should be able to work closely with others.

The apprenticeship program usually consists of 4 years of on-the-job training, in addition to a minimum of 144 hours of related classroom instruction each year. On the job apprentices learn elementary structural design and become familiar with the common systems of frame and concrete form construction. They also learn to use the tools, machines, equipment, and materials of the trade. In addition, they learn the many carpentry techniques, such as laying out, framing, and finishing.

Apprentices receive classroom instruction in drafting and blueprint reading, mathematics for layout work, and the use of woodworking machines. Both in the classroom and on the job they learn the relationship between carpentry and the other building trades, because the work of the carpenter is basic

to the construction process.

Hourly wage rates for apprentices usually start at about 50 percent of the journeyman carpenter's rate and increase by about 5 percent in each 6-month period, until a rate of 85 to 90 percent is reached during the last period of apprenticeship.

Young people interested in carpentry should obtain the all-around training given in apprenticeship programs. Carpenters with such training will have especially favorable long-range job prospects. They will be in much greater demand and will have better opportunities for advancement than those who can do only the relatively simple, routine types of carpentry.

Carpenters may advance to carpenter foremen or to general construction foremen. Carpenters usually have greater opportunities than most other building craftsmen to become general construction foremen since they are involved with the entire construction process. Some carpenters are able to become contractors and employ other journeymen. The proportion of self-employed is higher among carpenters than among most other building trades workers.

Employment Outlook

Employment of carpenters is expected to increase moderately through the mid-1980's. Tens of thousands of openings are expected each year because of both employment growth and the need to replace experienced carpenters who transfer to other fields of work, retire, or die.

The expected rise in construction activity, particularly homebuilding (see discussion in construction occupations introduction), is expected to result in a growing demand for carpenters. Additional carpenters also will be needed in the maintenance departments of factories, stores, large apartment projects, and government agencies.

Employment growth, however, will be limited by technological developments. For example, the use of construction materials prepared away from the building site will reduce the amount of carpentry required in a building. More widespread use of improved tools and equipment will increase the efficiency of carpenters.

Earnings and Working Conditions

Union minimum wage rates for carpenters in 68 large cities averaged $7.41 an hour in 1972, compared with $7.69 for all building trades journeymen. Minimum rates for carpenters in 14 of these cities, selected to show how wages differ among various areas of the country, are shown in the accompanying tabulation.

City	*Hourly rate*
Atlanta	$ 7.40
Boston	8.20
Charlotte	5.50
Chicago	7.65
Cleveland	9.45
Denver	6.57
Detroit	8.18
Los Angeles	6.75
New Orleans	6.57
Philadelphia	8.57
Pittsburgh	8.30
St. Louis	7.71
San Diego	7.06
Seattle	7.00

As in other building trades, the carpenter's work is active and sometimes strenuous, but exceptional physical strength is not required. However, prolonged standing, as well as climbing and squatting, are often necessary. Carpenters risk injury from slips or falls, from contact with sharp or rough materials, and from the use of sharp tools and power equipment. Many young persons like carpentry because they can work outdoors. Some worktime, however, is lost due to bad weather.

A large proportion of carpenters are members of the United Brotherhood of Carpenters and Joiners of America.

Sources of Additional Information

For information about carpentry apprenticeships or other work opportunities in this trade, contact local carpentry contractors or general contractors, a local union of the United Brotherhood of Carpenters and Joiners of America, a local joint union-management apprenticeship committee, or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Also, the local office of the State employment service can supply information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment services screen applicants and give aptitude tests.

General information on appren-

ticeship in this trade is also available from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, D.C. 20001.

CEMENT MASONS (CEMENT AND CONCRETE FINISHERS)

(D.O.T. 844.884 and 852.884)

Nature of the Work

Cement masons finish concrete surfaces on many types of construction projects. The projects range from finishing of small jobs, such as patios and floors, to work on huge dams, miles of concrete highways, and missile launching sites. Finishing concrete can provide wide variation; for example, cement masons may color concrete surfaces, expose aggregate in walls and sidewalks, or fabricate concrete beams, columns, and panels. In addition, materials other than concrete, such as latex and epoxy products applied to floors, vats, and tanks, have enlarged the cement mason's area of work.

On small projects, a mason, assisted by one or two helpers, may do all of the masonry work; on large projects, a crew of several masons and many helpers may be employed.

In preparing the site for pouring (placing) the concrete mixture, the cement mason makes sure that the forms, which are to mold the concrete, are set for the desired pitch and depth and are properly aligned. The mason directs the pouring of the concrete and supervises laborers who use shovels or special rakes to place and spread the concrete. The mason then levels the surface further using a "straightedge" (a rod made of wood or lightweight metal long enough to extend across the freshly poured concrete.) The concrete is now ready for intermediate and final finishing.

The cement mason uses special tools, such as a float, whip, or darby, to fill minor depressions and remove high spots. Final finishing is usually delayed until the concrete has hardened sufficiently to support the weight of a mason on kneeboards. While the concrete is still workable, he uses handtools—a wood or magsium float and a finishing trowel—to bring the concrete to the proper consistency and obtain the desired finish. Concrete finishing may be done also with power-operated trowels; however, edges, corners, and other inaccessible places must be finished by hand.

On concrete work, which is exposed (for example, columns, ceilings, and wall panels), cement masons correct surface defects and air pockets after the forms are stripped. This involves preparing the surface with a hammer and chisel and rubbing brick to remove high spots. A rich cement mixture is rubbed into the concrete surface using a sponge rubber float or piece of burlap to fill imperfections and voids. The end result is a uniformly smooth appearance.

Some cement masons specialize in laying a mastic coat (a fine asphalt mixture) over concrete, particularly in buildings where sound-insulated or acid-resistant floors are specified. Heavy hand tools are used to smooth the hot mastic.

Cement masons must know their materials and be familiar with various chemical additives which speed or slow the setting time. Because of the effects of heat, cold, and wind on the curing of cement, masons must be able to recognize by sight and touch what is occurring in the cement mixture so that they can prevent structural defects.

Places of Employment

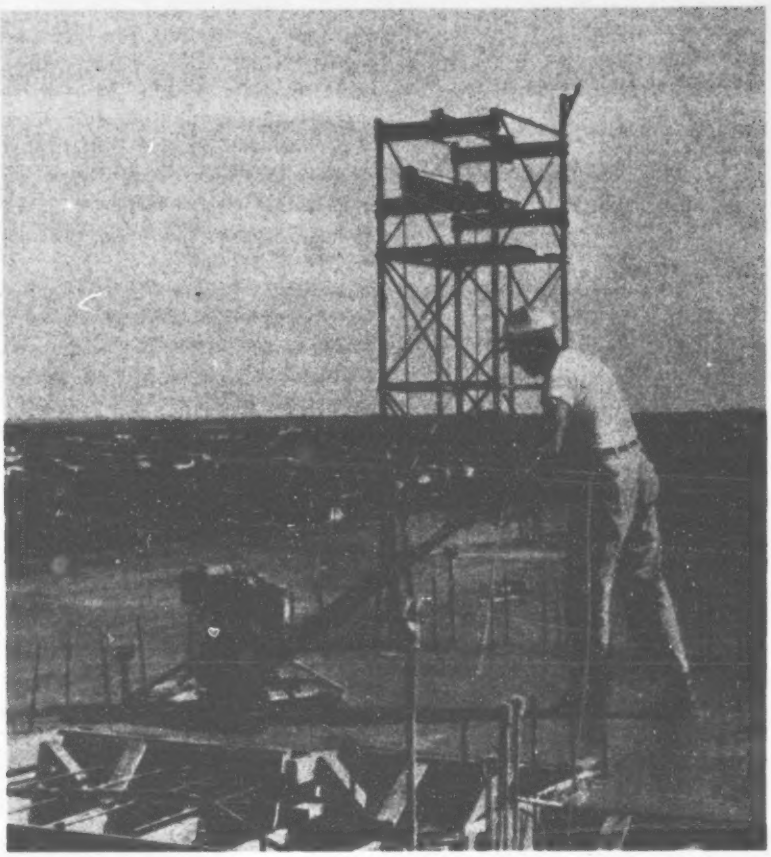
About 75,000 cement masons were employed in 1972. Cement masons work for general contractors who construct entire projects such as highways, or large industrial and residential buildings and for contractors who do only concrete work. Some masons install composition resilient floors for specialty floor contractors. A small number of masons are employed by municipal public works departments, public utilities, and manufacturing firms that do their own construction work. Others are self-employed and contract small jobs, such as sidewalks, driveways, patios, and curbs and gutters.

Training, Other Qualifications, and Advancement

Most training authorities recommend a 3-year apprenticeship program as the best way to learn this trade. A substantial number of workers, however, acquire cement masonry skills informally by working on construction jobs as laborers assisting cement masons.

Apprenticeship applicants generally must be 18 to 25 years old. Good physical condition and manual dexterity are important assets. Ability to work as part of a team and to direct the activities of others are also important.

The apprenticeship program usually consists of 2 to 3 years of on-the-job training, in addition to related classroom instruction. On the job, apprentices learn to use and handle the tools, equipment, machines, and materials of the trade. They also learn finishing, layout work, and safety techniques. In the classroom, apprentices receive instruction in subjects such as applied mathematics and related sciences, blueprint reading, architectural drawing, estimating materials and costs, and local building regulations. Al-



Cement mason operating troweling machine.

though a high school education is not required, education above the grade school level, preferably including mathematics, is needed to understand the classroom instruction.

Cement masons may advance to foremen or become materials and cost estimators for concrete contractors. Others may start their own concrete contracting businesses.

Employment Outlook

Employment of cement masons is expected to increase very rapidly through the mid-1980's. Thousands of openings are expected each year because of employment growth and the need to replace masons who transfer to other occupations, retire, or die.

Employment of cement masons will increase mainly because of the expected increase in construction activity (see discussion in construction occupations introduction), accompanied by the growing use of concrete and concrete products. For example, prestressed concrete makes possible wide spans where column-free construction is desired, and lightweight concrete wall panels that are fire- and weather-resistant are being used increasingly on nonload-bearing walls. Also, new products, such as epoxy and latex flooring systems, provide more job opportunities for cement masons.

Employment of cement masons is not expected to increase as rapidly as the use of concrete products. Many concrete products are precast and generally do not require finishing. The efficiency of masons also has increased through new and improved construction methods, materials, and equipment. For certain jobs, concrete can be applied pneumatically through hoses. Plastic forms provide a smooth surface and reduce rubbing and patching work. Worker efficiency has also been increased because of new machines, such as powered wheelbarrows, electric concrete vibrators, hydraulic joint-forming machines, powered concrete cutting saws, and cement-finishing machines.

Earnings and Working Conditions

Union minimum wage rates for cement masons in 68 large cities averaged $7.24 an hour in 1972, compared with $7.69 for all journeymen in the building trades. Minimum rates for cement masons in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rate*
Birmingham	$ 6.18
Boston	8.90
Charlotte	4.75
Cleveland	10.11
Columbus	7.55
Dallas	6.50
Denver	6.55
Fresno	7.13
Jacksonville	5.68
Milwaukee	7.19
Newark	9.00
Pittsburgh	8.24
Salt Lake City	7.00
Washington, D.C.	7.75

Cement masons usually receive premium pay for hours worked in excess of the regularly scheduled workday or workweek. They often

work overtime, because once concrete has been poured the job must be completed.

The work of the cement mason is active and strenuous, like the work of building tradesmen generally. Since most cement finishing is done on floors or at ground level the mason is required to stoop, bend, or kneel. Much of the work is done outdoors. Worktime is lost because of rain or freezing weather. In some cases, however, concrete can be poured year round by using heated, temporary shelters made of sheet plastic.

A large proportion of cement masons are union members. They belong either to the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or to the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For information about cement mason apprenticeships or other work opportunities in the trade, contact local cement finishing contractors; locals of unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may provide information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of cement masons may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

CONSTRUCTION LABORERS

(D.O.T. 809.887, 842.887, 844.887, 850.887 through 853.887; 859.887 through 862.887; 865.887, 866.887, and 869.887)

Nature of the Work

Construction laborers work on all types of construction projects—houses, highways, dams, airports, missile sites. They are usually the first workers to arrive on a construction project—assisting in site preparation—and the last to leave. They erect and dismantle scaffolding, set braces to support the sides of excavations, and clean up rubble and debris. Laborers also help unload materials, machinery, and equipment, and deliver these goods to building craftsmen such as carpenters and masons.

On alteration and modernization jobs, laborers tear out the existing work. They perform most of the work done by wrecking and salvage crews during the demolition of buildings.

When concrete is mixed at the worksite, laborers unload and handle materials and fill mixers with ingredients. Whether the concrete is mixed on-site or hauled in by truck, laborers pour and spread the concrete and spade or vibrate it to prevent air pockets. In highway paving, laborers clean the right-of-way, grade and help prepare the site, place the forms into which wet concrete is poured. They cover new pavement with straw, burlap, or other materials to keep it from drying too rapidly.

Some construction laborers have job titles that indicate the kinds of work they do. Bricklayers' tenders and plasterers' tenders, both commonly known as hod carriers, help bricklayers and plasterers by mixing and supply materials, setting up and moving portable scaffolding, and providing the many other services needed. Hod carriers must be familiar with the work of these craftsmen and have knowledge of the materials and tools used. Some hod carriers also help cement masons.

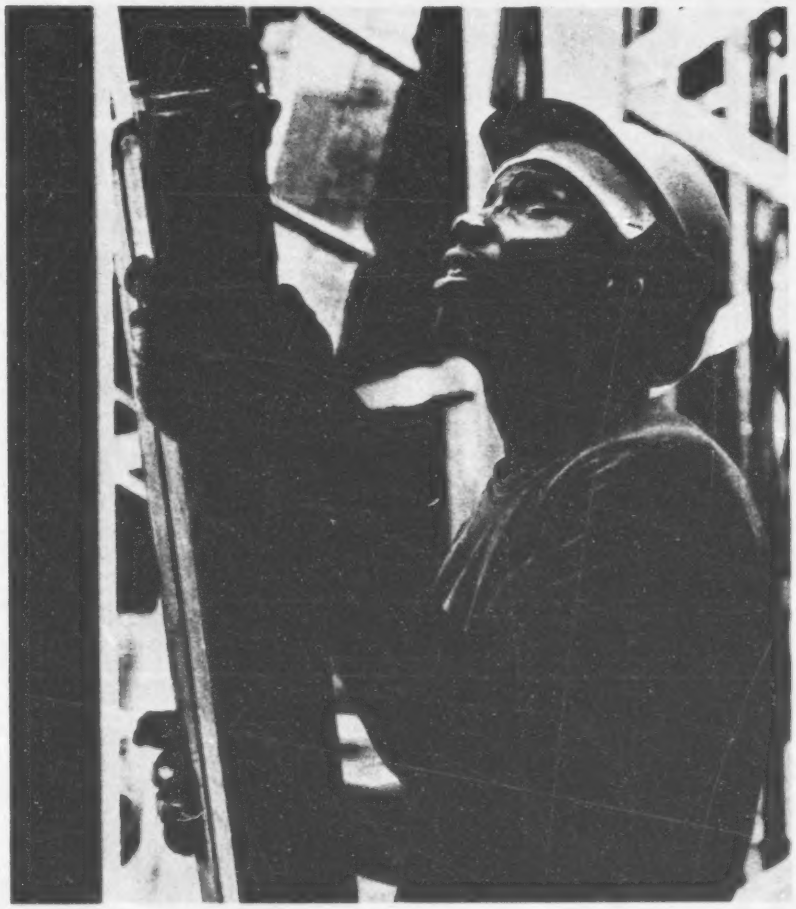
Construction laborers are commonly classified as unskilled workers, but this term can be misleading. Many jobs require training and experience, as well as a broad knowledge of construction methods, materials, and operations. Rock blasting, rock drilling, and tunnel construction are examples of work in which "know-how" is important. Laborers who work with explosives drill holes in rock, handle explosives, and set charges. They must know the effects of different explosive charges under varying rock conditions to prevent injury and property damage. Laborers do all the work in the boring and mining of a tunnel, including operations which would be handled by craftsmen if the job were located above ground.

Places of Employment

About 875,000 construction laborers were employed in 1972. Most of them worked for construction contractors, for State and city public works and highway departments, and for public utility companies.

Training, Other Qualifications, and Advancement

Little formal training is needed to get a job as a construction laborer. Generally, a young man must be at



least 18 years of age and in good physical condition. A laborer's first job is usually on the simplest type of work, but as he gains experience, he does more difficult tasks. If he works closely with a skilled craftsman for several years, he may be able to pick up the skills of the trade.

Many tasks assigned to laborers have, however, now become too complex to learn through on-the-job training alone. Recognizing this problem, contractors and unions have established formal training programs, lasting 4 to 8 weeks, in many areas of the country.

Employment Outlook

Employment of construction laborers is expected to increase slowly through the mid-1980's. Most job openings will occur as experienced laborers transfer to other occupations, retire, or die.

The anticipated large increase in construction activity (see discussion in construction occupations introduction) is expected to result in a growing demand for laborers, but this demand will be somewhat limited by more widespread use of mechanized equipment. For example, materials formerly handled at the construction site, such as brick, concrete, and lumber, are moved by forklift truck, powered wheelbarrows, and conveyor belts. Materials are lifted to the upper floors of high-rise buildings by automatic lifts and heavy duty cranes. The use of earth moving machines, including specialized equipment such as trenchers and front-end loaders, is also increasing.

Earnings and Working Conditions

Union minimum hourly wage rates for building laborers and bricklayers' tenders in 68 large cities averaged $5.57 and $6.06, respectively, in 1972, compared with $7.27 an hour for all building trade workers. Minimum rates for bricklayers' tenders and building laborers in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

	Hourly rate	
City	*Bricklayers' tenders*	*Building laborers*
Albuquerque	$4.32	$4.02
Baltimore	5.70	5.40
Buffalo	6.39	6.39
Cleveland	7.60	7.60
Columbus	6.26	6.06
Des Moines	6.19	6.19
Fresno	5.65	5.44
Los Angeles	5.85	5.50
Omaha	5.13	5.00
Phoenix	6.14	5.53
Providence	6.50	6.50
Richmond	3.60	3.50
Seattle	5.40	5.10
Tampa	4.93	4.78

Construction work is physically strenuous, since it requires frequent bending, stooping, and heavy lifting. Much of the work is performed outdoors, and some worktime is lost because of bad weather. Many construction laborers are members of the Laborers' International Union of North America.

Sources of Additional Information

For information about work opportunities as a construction laborer, contact local building or construction contractors, a local of the Laborers' International Union of North America or the local office

of the State employment service.

General information about the work of construction laborers may be obtained from:

Laborers' International Union of North America, 905 16th St. NW., Washington, D.C. 20006.

ELECTRICIANS (CONSTRUCTION)

(D.O.T. 821.381, 824.281, and 829.281 and .381)

Nature of the Work

Heat, light, power, air conditioning, and refrigeration components all operate through electrical systems that are assembled, installed, and wired by construction electricians. These craftsmen also install electrical machinery, electronic equipment, controls, and signal and communications systems. (Maintenance electricians, who usually maintain the electrical systems installed by construction electricians, are discussed elsewhere in the *Handbook*.)

Construction electricians follow blueprints and specifications for most installations. To install wiring, they may bend and fit conduit (pipe or tubing) inside partitions, walls, or other concealed areas. They then pull insulated wires or cables through the conduit to complete the circuit between outlets and switches. In lighter construction, such as housing, plastic-covered wire is usually used rather than conduit. In any case, electricians connect the wiring to circuit breakers, transformers, or other components. Wires are joined by soldering or mechanical means. When the wiring is finished, they test the circuits for proper connections and grounding.

Electricians, for safety reasons, must follow National Electrical Code regulations and, in addition, must fulfill requirements of State, county, and municipal electrical codes.

Electricians generally furnish their own tools including screwdrivers, pliers, knives, and hacksaws. Employers furnish heavier tools, such as pipe threaders, conduit benders, and most test meters and power tools.

Places of Employment

Most of the 240,000 construction electricians employed in 1972 worked for electrical contractors. Many others were self-employed contractors. A small number of electricians worked for government agencies or businesses that do their own electrical work. Construction electricians are employed throughout the country, but are concentrated in industrialized and urban areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn the electrical trade. However, some people learn the trade informally by working for many years as electricians' helpers. Many helpers gain additional knowledge by taking trade school or correspondence courses, or through special training in the Armed Forces.

The International Brotherhood of Electrical Workers and the National Electrical Contractors Association have jointly developed an extensive apprenticeship program. Apprenticeship applicants generally must be 18 to 24 years old, but exceptions may be made for veterans. A high school education is required; courses in mathematics and physics are desirable. Applicants usually are required to take tests to determine their aptitude for electrical work.

Apprenticeship programs are conducted under written agreement between the apprentice and the local joint union-management apprenticeship committee, which supervises the training. The committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards, and schedules a diversified, rotating work program. This program is designed to provide all-round training by having the apprentice work for several electrical contractors.

The apprenticeship program usually requires 4 years of on-the-job training, in addition to a mini-

mum of 144 hours of related classroom instruction each year in electrical layout, blueprint reading, mathematics, and electrical theory, including electronics. After completing their apprenticeships, many journeymen electricians enroll in courses, which may include advanced electronics, to keep abreast of the latest developments in this rapidly changing occupation.

Hourly wage rates of apprentices usually start at 40 to 50 percent of the journeyman rate and increase by 5 percent in each 6-month period until the journeyman's rate is reached.

To obtain a license, which is necessary in most cities, the electrician must pass an examination which requires a thorough knowledge of the craft and of State and local building codes.

Experienced construction electricians can transfer readily to other types of electrical work. For example, many take jobs as maintenance electricians in factories, and others work as electricians in shipbuilding and aircraft manufacturing.

Many electricians become foremen or superintendents for electrical contractors on construction jobs. Some become estimators for electrical contractors, computing material requirements and labor costs.

A large number of electricians start their own contracting businesses. In most large urban areas, a contractor must have a master electrician's license.

Employment Outlook

Employment of construction electricians is expected to increase rapidly through the mid-1980's. In addition to jobs from employment growth, many openings will arise as experienced electricians retire, die, or transfer to other occupations.

Employment of electricians is expected to increase mainly because of the anticipated expansion in construction; wiring for appliances, air-conditioners, and electrical heating in homes; and the extensive wiring for computers and electrical control devices in commerce and industry.

Earnings and Working Conditions

Union minimum wage rates for electricians in 68 large cities averaged $8.19 an hour in 1972, compared with $7.69 for all building trades journeymen. Because the seasonal nature of construction work affects electricians less than journeymen in most building trades, their annual earnings also tend to be higher. Average minimum rates for construction electricians in 14 of these cities, selected to show how wages differ among various areas, appear in the accompanying tabulation.

City	*Hourly rate*
Birmingham	$7.35
Buffalo	9.71
Charlotte	5.55
Columbus	8.63
Des Moines	8.15
Erie	8.95
Fresno	8.48
Grand Rapids	7.97
Little Rock	7.25
Louisville	8.98
Providence	8.15
Spokane	7.44
Trenton	10.35
Washington, D.C	8.85

Construction electricians are not required to have great physical strength, but they frequently must stand for long periods and work in cramped quarters. Because much of their work is indoors, electricians are less exposed to unfavorable weather than are most other construction workers. They risk falls from ladders and scaffolds, blows from falling objects, and electrical shock. However, safety practices have helped to reduce the injury rate.

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers.

Sources of Additional Information

For details about electrician apprenticeships or other work opportunities in this trade, contact local electrical contractors; a local union of the International Brotherhood of Electrical Workers; a local joint union-management apprenticeship committee, or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices screen applicants and give aptitude tests.

General information about the work of electricians may be obtained from:

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

National Electrical Contractors Association, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

National Joint Apprenticeship and Training Committee for the Electrical Industry, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

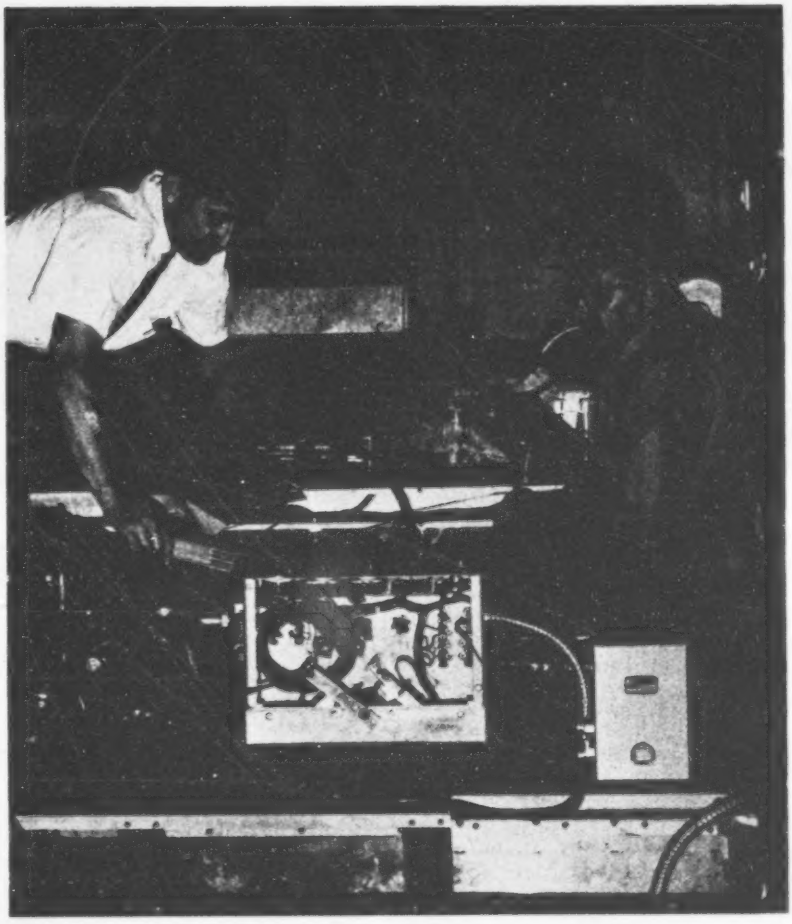
ELEVATOR CONSTRUCTORS

(D.O.T. 825.381 and 829.281)

Nature of the Work

Elevator constructors (also called elevator mechanics) assemble and install elevators, escalators, and similar equipment. In new buildings, they install equipment during construction. In older buildings, they replace earlier installations with new equipment. Once the equipment is in service, they maintain and repair it. Installation or repair work is usually performed by small crews consisting of skilled elevator constructors and their helpers.

In elevator construction, the crew first installs the guide rails of the car in the elevator shaft. Then they install the hoisting machines, the car frame and platform, controls, and other elevator parts. Next, the car frame is connected to a counterweight with cables, the cab body and roof are installed, and the control system is wired. Finally, the entire assembly is carefully adjusted and tested. Similar procedures are followed to install other equipment, such as escalators.



Elevator constructor and job superintendent check wiring system.

Alteration work on elevators is important because of the rapid rate of innovation and improvement in elevator engineering. This work is similar to new installation because all elevator equipment except the old rail, car frame, platform, and counterweight is generally replaced. Elevator mechanics inspect elevator and escalator installations periodically and, when necessary, adjust cables and lubricate or replace parts.

To install and repair modern elevators, most of which are electrically controlled, elevator constructors must have a working knowledge of electricity, electronics, and hydraulics. They also must be able to repair electric motors, as well as control and signal systems. Because of the variety of their work, they use many different handtools, power tools, and testing meters and gages.

Places of Employment

Most of the estimated 17,000 elevator constructors in 1972 were employed by elevator manufacturers to do installation, modernization, and repair work. Some are employed instead by small, local contractors who specialize in elevator maintenance and repair. Still others work for government agencies or business establishments that do their own elevator maintenance and repair. Elevator constructors are employed as elevator inspectors, also, for municipal or other government licensing and regulatory agencies.

Training, Other Qualifications, and Advancement

Most elevator constructors begin as helpers and learn their skills primarily through on-the-job training.

The helper-trainee must be at least 18 years of age, in good physical condition, and have a high school education or its equivalent, preferably including courses in mathematics and physics. Mechanical aptitude and an interest in machines are also important.

To become a skilled elevator constructor, at least 2 years of continuous job experience, including 6 months' on-the-job training at the factory of a major elevator firm, is usually necessary. During this period, the helper learns to install, maintain, and repair elevators, escalators, and similar equipment. The helper-trainee generally attends evening classes in vocational schools. Among the subjects studied are mathematics, physics, electrical and electronic theory, and safety techniques.

Elevator constructors may advance to foremen for elevator manufacturing firms. A few may establish small contracting businesses; however, opportunities are limited.

Employment Outlook

A very rapid increase in employment of elevator constructors is expected through the mid-1980's. A few thousand job openings will become available each year because of employment growth and the need to replace experienced workers who transfer to other fields of work, retire, or die.

More elevator constructors will be needed because of growth in the number of new industrial, commercial, and apartment buildings (see discussion in construction occupations introduction). In addition, technological developments in elevator and escalator construction will spur modernization of older installations and thus contribute to the need for these craftsmen. Also, installation and adjustment of automatic control systems on modern elevators require more work and higher skill levels.

Earnings and Working Conditions

Both the hourly wage rates and the annual earnings of elevator constructors are among the highest in the skilled building trades. These craftsmen lose less worktime because of seasonal factors than do most other building trades workers.

Union minimum wage rates for elevator constructors in 68 large cities averaged $8 an hour in mid-1972, compared with $7.69 for all building trades journeymen. Minimum rates for elevator constructors in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rate*
Baltimore	$ 7.92
Chicago	8.75
Cleveland	9.44
Denver	7.47
Fresno	8.99
Houston	6.60
Jacksonville	6.84
Little Rock	6.02
Los Angeles	9.21
Madison	6.75
Philadelphia	9.15
Providence	7.93
Richmond	6.22
Rochester	8.56

Elevator construction involves lifting and carrying heavy equipment and parts, but this is usually done by helpers. Most of the work takes place indoors—sometimes in cramped and awkward positions.

Most elevator constructors are members of the International Union of Elevator Constructors.

Sources of Additional Information

For further details about work opportunities as a helper in this trade, contact elevator manufacturers, elevator construction or maintenance firms, or a local of the International Union of Elevator Constructors. In addition, the local office of the State employment service may have information about opportunities in this trade.

General information about the work of elevator constructors may be obtained from the International Union of Elevator Constructors, 12 South 12th St., Philadelphia, Pa. 19107.

FLOOR COVERING INSTALLERS

(D.O.T. 864.781)

Nature of the Work

Floor covering installers (also called *floor covering mechanics* and *floor layers*) install, remove, and repair floor coverings, including resilient tile, linoleum and vinyl sheets, and carpeting. These craftsmen install coverings over floors made of wood, concrete, or other materials. They generally specialize in either carpet or resilient floor installation, although some can install both types.

Before putting down resilient covering (such as asphalt tile) installers first inspect the floor to be sure that it is firm, dry, smooth, and free of dust or dirt. Some floors have to be prepared for covering. For example, installers may sand a rough or painted floor and fill cracks and indentations. An extremely uneven floor may be resurfaced with wood or other materials.

On newly poured concrete floors or floors laid over earthwork, installers test for moisture content. If the moisture is too great, they may suggest postponing installation of floor covering or recommend a covering technique suited to the floor's condition.

Installers of resilient flooring meas-

ure and mark off the floor according to a plan. The plan may be architectural drawings that specify every detail of the covering design, or a simple, verbal description by the customer. When the plan is completed, installers, often assisted by apprentices or helpers, cut, fit, and glue the flooring into place. It must be carefully fit, particularly at door openings, along irregular wall surfaces and around fixtures, such as columns or pipes. Installers must take special care also in cutting out and setting in decorative designs. After the flooring is in place, they run a roller over it to insure good adhesion.

Carpet craftsmen, like the installer of resilient coverings, first inspect the floor to determine its condition. Then they plan the layout after allowing for expected traffic patterns so that best appearance and long wear will be obtained. To hold the carpet after it is installed, craftsmen fasten tackless strips with adhesive, nails, or tacks along the borders. Padding is cut and placed along the framework of the strip and the carpet is placed approximately in position. If the carpet has not been precut and seamed, installers will do this work before stretching it into place. Edges are trimmed for a secure and smooth fit.

Places of Employment

An estimated 60,000 floor covering installers were employed in 1972. Most worked for flooring contractors. Many others worked for retailers of floor covering and home alteration and repair contractors.

Installers can find jobs throughout the Nation, but most are concentrated in urban areas that have high levels of construction activity.

Training, Other Qualifications, and Advancement

Employers prefer applicants with a high school education, but this qualification generally is not required. Most seek applicants 17 to 30 years of age who have average physical strength and manual dexterity. A neat appearance and a pleasant business-like manner also are important, because the work is performed on the customer's premises.

Training authorities generally recommend a 3- or 4-year apprenticeship program as the best way to learn the floor covering trade. Many people, however, have learned the trade by observing and working with experienced installers.

Most apprenticeship programs include on-the-job training and classroom instruction. Apprentices attend classes to learn about materials they will be using, and the use and care of tools and equipment. They also study the mathematics of layout work, interpretation of architectural drawings, and planning and layout techniques. Some apprenticeship programs cover either carpet or resilient floor covering work; others cover both.

Skilled floor covering installers may advance to foremen or installation managers for large floor laying firms. Some become salesmen or estimators. Floor covering installers may go into business for themselves.

Employment Outlook

Employment of floor covering installers is expected to increase

rapidly through the mid-1980's. In addition to job openings resulting from employment growth, many openings will arise as experienced installers transfer to other fields of work, retire, or die.

Employment of floor covering installers is expected to increase mainly because of the expected expansion in construction and the more widespread use of resilient floor coverings and carpeting. In many new buildings plywood has replaced hardwood flooring, thus making wall-to-wall carpeting a necessity. More versatile materials and colorful patterns also will contribute to the growing demand for floor coverings. The best job opportunities will be for installers who have all-round training.

Earnings and Working Conditions

Information from a limited number of firms indicates that most experienced floor layers earned between $5 and $7 per hour in 1972, although rates ranged from about $4 an hour in some areas to more than $8.75 an hour in others. Starting wage rates for apprentices and other trainees usually are about half of the experienced worker's rate.

Most floor covering installers are paid by the hour. In some shops, part of the installer's pay may be in bonuses. In others, installers receive a monthly salary or are paid according to the amount of floor covering they install.

Floor covering installers generally work regular daytime hours. Particular circumstances, however, such as installing a floor in a store or office, may require work during evenings or weekends.

Unlike many construction craftsmen, floor coverers usually do not lose time due to weather conditons. During the winter, most work is done in heated buildings. The job is not hazardous, but installers may get back injuries from lifting heavy materials and knee injuries from working in a kneeling position for long periods. Most injuries can be avoided if proper work procedures are followed

Many floor covering installers belong to unions including the United Brotherhood of Carpenters and Joiners of America, and the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For details about apprenticeships or work opportunities in the trade, contact local flooring contractors or retailers; a local union of the United Brotherhood of Carpenters and Joiners of America (in Eastern States); a local union of the International Brotherhood of Painters and Allied Trades (in Western States); or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Local offices of the State employment services may have information about apprenticeship, the Manpower Development and Training Act, and other programs that provide training opportunities.

General information about the work of floor covering installers may be obtained from:

Carpet and Rug Institute, P.O. Box 2048, Dalton, Ga. 30720.

Resilient Tile Institute, 101 Park Ave., New York, N.Y. 10017.

GLAZIERS

(D.O.T. 865.781)

Nature of the Work

Construction glaziers install plate glass, ordinary window glass, mirrors, and special items such as leaded glass panels. To install windows, glaziers cut the glass to size and use precut pieces. They apply putty to the window frames, press the glass into place, and secure it with wire clips or triangular metal points. They then place another strip of putty outside the window to keep out moisture.

To install structural glass on walls and partitions, glaziers press glass into cement which has been applied to the supporting backing. They may use a cutter to trim glass which has not been precut. Glaziers install many kinds of structural glass, including shower doors and bathtub enclosures, mirrors of all types, and automatic glass doors.

Glaziers use handtools, such as glass cutters and putty knives, and power tools, such as cutters and grinders.

Places of Employment

About 12,000 construction glaziers were employed in 1972. Most worked for glazing contractors engaged in new construction, alteration, and repair. Others worked for government agencies or businesses that do their own construction work.

About 15,000 glaziers worked outside the construction industry. Many are employed in factories to install glass in windows, doors, and mirror frames. Others install glass or mirrors in furniture or replace automobile windshields and windows.

Training and Other Qualifications

Most training authorities recommend the completion of a 3-year apprenticeship program as the best way to learn glazier skills. A substantial proportion of glaziers, however, have learned the trade informally by working for, observing, and being taught by experienced glaziers. In smaller communitites, many painters and paperhangers also learn to do glazing work as part of the training for their trade.

Apprenticeship applicants generally must be 18 to 26 years old; veterans are exempt from the maximum age limit. A high school diploma or its equivalent is required. The apprenticeship program usually consists of 3 years of on-the-job training, in addition to a minimum of 144 hours of classroom instruction each year. On the job, apprentices learn to use the tools, equipment, and materials of the trade. Classroom instruction includes mathematics, blueprint and job specifications reading, design and layout planning, safety measures, and first aid.

Glazier apprentices usually start at 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of training.

Employment Outlook

A very rapid increase in employment of construction glaziers is expected through the mid-1980's. In addition to jobs created by employment growth, openings will arise as experienced glaziers transfer to other occupations, retire, or die.

The anticipated increase in construction activity and the trend toward the use of more glass in buildings are expected to result in more work for glaziers. Replacement and modernization work, frequently involving large glass installations, also will contribute to the demand for these workers.

Earnings and Working Conditions

Union minimum hourly wage

rates for construction glaziers in 68 large cities averaged $7.23 in 1972, compared with $7.69 for all building trades journeymen. Hourly rates for construction glaziers in 14 of these cities, selected to show how wages differ among various areas, appear in the accompanying tabulation.

City	*Hourly rate*
Albuquerque	$5.09
Atlanta	6.80
Baltimore	7.30
Cleveland	9.36
Dallas	6.18
Detroit	8.00
Jackson	4.95
Kansas City	7.91
Los Angeles	8.17
Madison	6.85
Providence	7.56
San Diego	8.55
Spokane	5.89
Trenton	7.73

Glaziers may be injured by glass edges, cutting tools, plate glass lifting, or falls from scaffolding. To reduce injuries, employers and unions emphasize safety training.

Many glaziers employed in construction are members of the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For more information about glazier apprenticeships or work opportunities, contact local glazing or general contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship agency, or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Local offices of the State employment services may have information about the Manpower Development and Training Act, apprenticeship, and other training opportunities.

General information about the work of glaziers may be obtained from the International Brotherhood of Painters and Allied Trades, 1925 K St. NW., Washington, D.C. 20006.

LATHERS

(D.O.T. 842.781)

Nature of the Work

Lathers install supports that hold plaster, stucco, or concrete materials. These supports usually are either metal lath (strips of expanded metal or a metal wire mesh) or gypsum lath boards. Plaster, mixed properly, easily sticks to either type of lath.

When installing metal lath, the lathers first build a light metal framework (furring), which is fastened to the structural framework of the building. On many ceilings or walls; however, the lath may be attached directly to the wood framework or partitions. In either method, attachment to the furring or framework may be done by nailing, clipping, wire-tying, or machine stapling. As the lath is being installed, lathers cut openings for electrical outlets and piping. Gypsum lath boards are installed in much the same way. The method of installation varies slightly in other types of lath work. For example, when cornices or other ornamental plaster shapes are specified, the lather builds the framework that approximates the desired shape or form. Metal lath is then attached to the framework.

Lathers install wire mesh reinforcement in all inside angles and corners to prevent structural cracking. On outside or exposed corners, a metal reinforcement called a corner bead is attached for protection and strength.

When stucco (a mixture of portland cement and sand) is to be applied over wood framework, lathers install two layers of wire mesh, separated by a layer of felt, to act as a base.

The tools of the trade include drills, hammers, hacksaws, shears, wirecutters, hatchets, stapling machines, and powder- or power-actuated fastening devices.

Places of Employment

Most lathers—who numbered about 30,000 in 1972—work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. Some lathers are employed outside the construction industry; for example, they make the lath backing for plaster display materials or scenery.

Training, Other Qualifications, and Advancement

Most training authorities recommend 2 years of apprenticeship as

the best way to learn lathing. However many lathers, particularly in small communities, have acquired skills informally, by working as helpers, observing, or being taught by experienced lathers.

Apprenticeship applicants generally must be 16 to 26 years old and in good physical condition. Aptitude tests often are given to determine whether applicants have manual and finger dexterity, as well as other qualifications. Apprentices generally must pass examinations that are given at the end of each 6-month period.

On the job, apprentices learn to use and handle the tools and materials of the trade. For example, they install gypsum lath, wall furring, and metal lathing. In addition, they generally receive classroom instruction in subjects such as applied mathematics, geometry, reading of blueprints and sketches, welding, estimating, and safety practices. Today, a high school education is encouraged, and education above grade school level, particularly courses in mathematics, is needed to understand apprenticeship classroom instruction.

Hourly wage rates for lather apprentices usually start at 50 percent of the journeyman rate. The rate is increased periodically by 5 percent every third or fourth month until a rate of 85 percent is reached in the final quarter of the second year of training.

Some experienced lathers may become foremen. Others may be able to start their own lath contracting business.

Employment Outlook

Employment of lathers is expected to increase rapidly through the mid-1980's. In addition to employment growth, job openings will arise as experienced lathers retire, die, or transfer to other occupations. Retirements and deaths alone will provide a few hundred openings annually.

Employment is expected to grow primarily as a result of the anticipated large increase in construction activity. Moreover, the increasing use of new plasters and improved methods of applying plaster will increase the need for lathers. Demand for these workers also may be stimulated by the trend to curved surfaces and ceilings made of plaster, both as a form of architectural treatment and to achieve special lighting and acoustical effects. Machine plastering and fireproofing are growing in importance. Because these machines reduce the cost of plastering, their greater use should increase the demand for plaster work and for lathers. These developments are expected to more than offset the loss of lathing work resulting from the use of nonplaster (dry-wall) construction.

Earnings and Working Conditions

Union minimum wage rates for lathers in 68 large cities averaged $7.67 an hour in 1972, compared with $7.69 for all journeymen in the building trades. Hourly rates for lathers in 14 of these cities, selected to show how wages vary among different areas, appear in the accompanying tabulation.

City	*Hourly rate*
Boston	$ 7.50
Charlotte	4.98
Cleveland	10.41
Des Moines	7.35
Knoxville	6.20
Los Angeles	8.05
Louisville	7.84
Newark	7.90
Peoria	7.33
Philadelphia	8.54
Rochester	8.68
Sacramento	7.20
Shreveport	6.63
Washington, D.C	7.68

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union.

Sources of Additional Information

For information about lathers' apprenticeships or other work opportunities in the trade, contact a local lathing or plastering contractor; a local of The Wood, Wire and Metal Lathers International Union; a local joint labor-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Local offices of the State employment services may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of lathers may be obtained from:

International Association of Wall and Ceiling Contractors, 1775 Church St., NW., Washington, D.C. 20036.

International Council for Lathing and Plastering, 221 North LaSalle St., Chicago, Ill. 60601.

National Lathing Industries Joint Apprenticeship Program, 140 Main St., Annapolis, Md. 21401.

The Wood, Wire and Metal Lathers International Union, 6530 New Hampshire Ave., Takoma Park, Md. 20012.

MARBLE SETTERS, TILESETTERS, AND TERRAZZO WORKERS

(D.O.T. 861.381 and .781)

Nature of the Work

Marble setters install marble, terrazzo panels, and structural glass in large buildings and other structures. Tilesetters attach tile to

walls, floors, and ceilings. Terrazzo workers apply an ornamental concrete used mainly for floors in buildings such as stores, offices, and hospitals.

Marble is often used as a facing for concrete walls, columns, and floors. To set marble panels in a wall, marble setters drill holes in the edges of the marble and fasten anchors in the holes. They then apply a plaster mixture to the wall and set the marble in place. A special cement mixture is packed into the joints between the pieces and then finished with a trowel. Marble setters' helpers mix plaster and cement, carry marble slabs, and clean the completed work.

Tilesetters apply a cement-like coating to the wall, floor, or other surface that is to be covered with tile. In some cases, the coating is applied to the back of the tile. Tilesetters put each tile into place and tap it so that it will stick securely to the wall or floor. To fit tile in corners or around pipes, they use chisels and other tools to shape each piece to proper size. Tilesetters usually are assisted by helpers who carry materials, mix cement, and clean up after the job is finished.

Terrazzo is a tinted ornamental concrete with marble chips, and is used primarily for floors. Terrazzo workers lay a base of cement mortar and then level it with a long rod or straightedge. Metal strips are placed in the mortar base wherever there is to be a joint or change of color between panels. Terrazzo workers mix the top layer of cement and marble chips, pour it onto the base, and then roll and level it. After the mixture has hardened for a few days, the terrazzo floor is ground and polished with a grinding machine.

Terrazzo workers are assisted by helpers who carry cement, sand, and other materials, and mix and pour base and terrazzo mixtures. Helpers also grind, polish, and clean floors.

Places of Employment

Marble setters, tilesetters, and terrazzo workers—who numbered about 35,000 in 1972—are employed mainly in nonresidential construction projects, such as schools, hospitals, and public and commercial buildings. These craftsmen work throughout the country, but they are found largely in the more populated urban areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 3-year apprenticeship program as the best way to learn each of these trades. A substantial proportion of tilesetters, terrazzo workers, and marble setters, however, acquire their skills informally by working as helpers and being taught by experienced craftsmen.

Apprenticeship applicants generally must be 17 to 22 years old; a high school education or its equivalent is desirable. Good physical condition and manual dexterity are important assets. Applicants should have a good sense of color harmony.

The apprenticeship programs in each of these trades generally consist of on-the-job training and related classroom instruction in subjects such as blueprint reading, layout work, and basic mathematics.

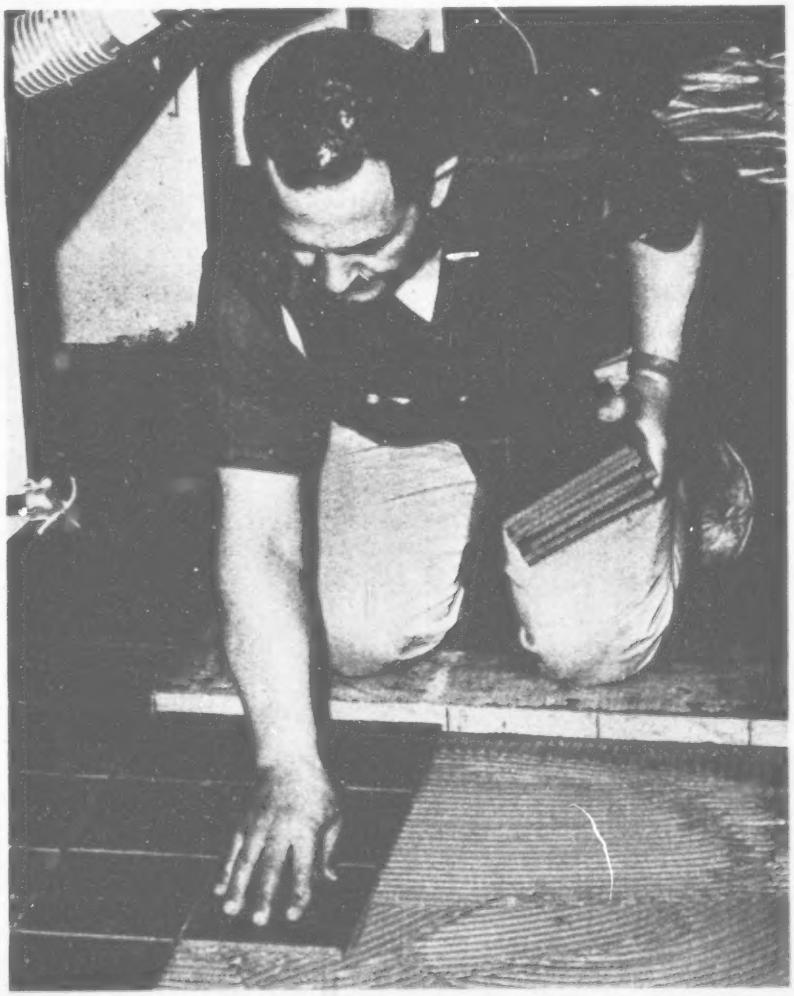
Hourly wage rates for apprentices start at about 50 or 60 percent of the journeyman rate and increase periodically until 95 percent

of the journeyman rate is reached during the last period of apprentice training.

Skilled tile, terrazzo, or marble setters may become foremen or start their own contracting businesses.

Employment Outlook

Employment of terrazzo workers and tilesetters is expected to increase moderately through the mid-1980's because of the expected expansion in construction activity. Growth in these two crafts, however, will be limited by the increasing use of such competing materials as resilient flooring, paving brick, and plastic-coated wallboard, which usually are installed by workers in other trades. Most job openings for terrazzo workers and tilesetters will result from the need to replace experienced craftsmen who retire, die, or transfer to other occupations.



Tilesetter installs ceramic floor tile.

Despite rising construction activity, employment of marble setters is not expected to change significantly through the mid-1980's. Marble is a very expensive building material. Although it will continue to be installed in some buildings, the trend is to less costly materials. Nevertheless a small number of job openings will arise as some experienced marble setters retire, die, or transfer to other occupations.

Earnings and Working Conditions

In 1972, union minimum hourly wage rates for terrazzo workers in 68 large cities averaged $7.52; for marble setters, $7.50; and for tilesetters, $7.16. In comparison, union minimum rates for all building trades journeymen averaged $7.69 an hour. Average minimum rates for these three crafts in 14 of the cities, selected to show how wages differ among various areas, appear in the accompanying tabulation.

City	Hourly rates		
	Marble setters	*Tile-setters*	*Terrazzo workers*
Atlanta	$6.75	$6.75	$6.75
Baltimore	8.60	6.99	6.99
Boston	7.65	8.10	7.65
Chicago	8.77	8.15	7.35
Cleveland	8.86	9.94	8.70
Dallas	6.50	6.90	6.90
Denver	6.83	6.83	6.83
Detroit	9.84	8.76	8.47
Little Rock	5.75	5.75	5.75
New Orleans	6.95	6.55	6.55
Norfolk	5.10	5.10	5.10
Sacramento	—	7.25	8.20
Spokane	8.15	8.21	8.40
Toledo	8.78	8.29	8.29

Marble setters and terrazzo workers work both indoors and outdoors, depending on the type of installation. Tilesetters work mostly indoors.

The principal unions organizing these workers are the Bricklayers,

Masons and Plasterers' International Union of America; and the International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers.

Sources of Additional Information

For details about apprenticeship or other work opportunities in these trades, contact local tile, terrazzo, and marble setting contractors or locals of the unions previously mentioned. In addition, the local office of the State employment service may provide information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of marble setters, tilesetters, and terrazzo workers may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers, 821 15th St. NW., Washington, D.C. 20005.

National Terrazzo and Mosaic Association, Inc., 716 Church St., Alexandria, Va. 22314.

Tile Contractors' Association of America, Inc., 112 North Alfred St., Alexandria, Va. 22314.

OPERATING ENGINEERS (CONSTRUCTION MACHINERY OPERATORS)

(D.O.T. 850.782 through .887, 851.883 and .887, 852.883, 853.782 and .883, 859.782, and 859.883)

Nature of the Work

Operating engineers are at the controls of bulldozers, cranes, trench excavators, and many other types of construction machinery. These craftsmen have a wide range of skills and work with many different machines—some complex and others relatively simple. The duties of engineers who operate cranes and earthboring machines describe these skills.

The crane operator manipulates various pedals and levers to rotate the crane and to raise and lower the boom and loadline. If not controlled properly large cranes can damage property and endanger other workers at the construction site, so operators must judge distances accurately and handle controls precisely. Cranes are very versatile when equipment is attached; for example, buckets lift dirt, pile drivers hammer steel beams into the ground, and wrecking balls do demolition work. In comparison, earthboring machine operators need less skill to set the proper auger (drill) in the spindle, start the machine, and stop its boring at the correct depth.

Operating engineers often are identified by the machines they use; for example, craneman, bulldozer operators, or derrickman. An individual who wants steady employment, however, should know how to operate several different machines.

Places of Employment

An estimated 310,000 operating engineers were employed as excavating, grading, and road machinery operators in 1972. In addition, about 125,000 worked as bulldozer

operators. Many operating engineers were employed on other construction machinery, including cranes, derricks, hoists, air-compressors, trench-pipe layers, and dredges.

Most operating engineers work for contractors in highway, dam, airport, and other large-scale construction projects. Others work for utility companies, manufacturers, and other business firms that do their own construction work, as well as State and local highway and public works departments. A few operating engineers are self-employed. Some operating engineers control cranes, hoists, and other power-driven machinery in factories and mines.

Operating engineers are employed in every section of the country. Some work on highways and dams being built in remote locations.

Training, Other Qualifications, and Advancement

Most training authorities recommend completion of a 3-year apprenticeship as the best way to become a journeyman operating engineer. Since apprentices learn to operate a variety of machines, they have many job opportunities.

The apprenticeship program consists of at least 3 years of on-the-job training, as well as 144 hours a year of related classroom instruction. Apprenticeship applicants generally must be 18 to 30 years old; in good physical condition; have a high school education or its equivalent; and the ability and aptitude to master the trade.

Hourly wage rates for apprentices start at about 65 percent of the journeyman rate and increase periodically until the journeyman rate is reached.

Many young people who enter this occupation as oilers (operating engineer's assistants) or as helpers to heavy equipment repairmen, learn to repair and maintain machinery. In time, they may receive instruction on machine operation from experienced engineers. Farm equipment workers may get jobs operating simple construction machines.

City	Hourly rates		
	Crane operator	Bulldozer operator	Air compressor operator
Baltimore	$ 7.65	$6.97	$6.34
Boston	8.71	8.59	7.23
Cincinnati	8.63	8.48	8.33
Denver	5.80	5.65	5.15
Erie	9.18	9.03	8.45
Houston	6.65	6.65	6.01
Los Angeles	7.91	7.81	7.03
Milwaukee	8.27	8.02	7.17
Newark	11.88	—	8.51
Norfolk	5.90	4.70	3.95
Omaha	6.80	6.55	6.00
Phoenix	8.55	8.27	6.42
San Diego	7.81	7.71	6.83
Tampa	8.44	7.24	5.69

Employment Outlook

Employment of construction machinery operators is expected to increase rapidly through the mid-1980's. Thousands of openings are expected each year because of both employment growth and the need to replace experienced craftsmen who transfer to other fields of work, retire, or die.

The rise in construction, particularly highway construction, is expected to increase the demand for operating engineers. More workers also will be needed for highway maintenance. In addition, the increasing mechanization of materials movement in factories and mines should result in growing employment of operating engineers outside of construction.

Earnings and Working Conditions

Wage rates for operating engineers vary according to the machine operated, its capacity, and sometimes, the construction activity in which it is used. Union minimum hourly rates for crane, bulldozer, and air-compressor operators in 14 cities in 1972, selected to show how wages differ among various occupations and areas of the country, appear in the accompanying tabulation.

Operating engineers work outdoors; consequently, they usually work steadily during the warmer months and experience slow periods during the colder months. Time also may be lost due to rain or snow. The operation of some machines, particularly bulldozers and some types of scrapers, is physically tiring because the constant movement of the machine shakes or jolts the operator.

Many operating engineers are members of the International Union of Operating Engineers.

Sources of Additional Information

For further information about apprenticeships or work opportunities in this occupation, contact local general contractors; a local of the International Union of Operating Engineers; a local joint apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Appren-

ticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may provide information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of operating engineers may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

International Union of Operating Engineers, 1125 17th St. NW., Washington, D.C. 20036.

PAINTERS AND PAPERHANGERS

(D.O.T. 840.381, .781 and .884, and 841.781)

Nature of the Work

Painting and paperhanging are separate, skilled trades, although many craftsmen do both types of work. Both apply finishes to walls and other building surfaces, but the materials they use and the methods of application differ.

Painters apply paint, varnish, and other finishes to building surfaces to decorate or protect them. Paperhangers cover interior walls and ceilings of rooms with decorative wallpaper, fabric, vinyl, or similar materials.

One of the primary duties of painters is to prepare the surface to be painted. They must remove loose paint by scraping, or by heating with a blowtorch and then scraping. They also must remove dust and grease, fill nail holes and cracks, sandpaper rough spots, and brush off dust. When painting new surfaces, they usually cover them with a prime sealer or coat to make a suitable surface or base for the finish coat.

Painters must be skilled in handling brushes and other painting tools so that they can apply paint thoroughly, uniformly, and rapidly to any type of surface. They must be able to mix paints and match colors, using a knowledge of paint composition and color harmony. They also must know the characteristics of common types of paints and finishes from the standpoints of durability, suitability for different purposes, and ease of handling and application.

Painters often use rollers or spray guns instead of brushes. Rollers are used on even surfaces such as walls and ceilings. Spray guns are used on surfaces that are difficult to paint with a brush, such as cinder block and metal fencing. Both rollers and spray guns permit faster painting, thus reducing labor costs.

Painters also erect scaffolding, including "swing stages" (scaffolds suspended by ropes or cables attached to roof hooks) and "bosun chairs," which they use when working on tall buildings and similar structures.

The first step in paperhanging is to prepare the surface to be covered. Paperhangers apply "sizing", a prepared material that makes the plaster less porous and assures better sticking of the paper to the surface. In doing redecorating work, they may have to remove old paper by soaking or—if there are many layers—by steaming. Frequently, it is necessary for paperhangers to do minor plaster patching.

Paperhangers measure the area

to be covered and cut a length from the roll of wallpaper, after carefully positioning the patterns to match at the ceiling and baseboard. They then apply paste to the strip of paper, place it on the wall, and smooth it by hand or with a brush. They cut and fit edges at ceiling and base, and smooth seams between strips with a roller or other special tool. They inspect the paper for air bubbles and other imperfections in the work. Air bubbles are removed by smoothing the paper strip toward the outer edges. When working with wall coverings other than paper, paperhangers follow the same general procedure.

Places of Employment

About 410,000 painters and 10,000 paperhangers were employed in 1972. Many worked for contractors engaged in new construction, repair, alteration, or modernization work. Hotels, office buildings, shipyards, manufacturing firms, schools, and other organizations that own or manage extensive property holdings also employ maintenance painters. When interior redecorating involves wallpapering, as in hotels or apartment buildings, maintenance painters also may do the paperhanging.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 3-year formal apprenticeship as the best way to become a journeyman painter or paperhanger. A substantial proportion of painters and paperhangers, however, learn the trade informally, working as helpers to experienced craftsmen. Workers without formal apprentice training have gained acceptance as journeymen more easily in these crafts than in most of the other building trades.

Apprentice applicants generally must be 16 to 25 years old and in good physical condition. A high school education is preferred, although not essential. Applicants should have manual dexterity and a discerning color sense. They cannot be allergic to fumes from paint or other materials used in these trades.

The apprenticeship for painters and paperhangers generally consists of 6,000 hours (3 years) of on-the-job training, in addition to 144 hours a year of related classroom instruction. Apprentices receive instruction in subjects such as color harmony; paint chemistry; cost estimating; and paint mixing and matching. They also learn the relationship between painting and paperhanging and the work performed by the other building trades craftsmen. Many apprenticeships combine painting and paperhanging.

Hourly wage rates for apprentices usually start at 50 percent of the journeyman rate and increase periodically until the journeyman rate of pay is reached upon completion of apprenticeship.

Painters and paperhangers may advance to foremen. They also may advance to jobs as cost estimators for painting and decorating contractors. Some may become superintendents on large contract painting jobs, or they may establish their own painting and decorating businesses.

Employment Outlook

Employment of painters is expected to increase slowly through the mid-1980's. In addition to employment growth, many new workers will be needed each year to replace experienced painters who transfer to other fields of work, retire, or die.

The large rise anticipated in construction activity (see discussion in construction occupations introduction) is expected to result in a growing demand for painters. Moreover, recently developed paints, such as polyester, epoxy and vinyl coatings, that resist heat, abrasion, and corrosion, have resulted in new uses for paints and additional job opportunities for painters. Furthermore, a growing number of painters are expected to be needed in the maintenance departments of large industrial and commerical firms.

Although the total number of openings for paperhangers will be small, employment is expected to increase rapidly through the mid-1980's. More paperhangers will be needed as construction activity rises. Also, greater use of fabric, vinyl, plastic, and similar wall coverings should contribute to the demand for these workers. In addition, job openings will arise as experienced paperhangers transfer to other fields of work, retire, or die.

Earnings and Working Conditions

Union minimum hourly rates for painters and paperhangers in 68 large cities averaged $7.06 and $7.09, respectively, in 1972. In comparison, the average rate for all building trades journeymen was $7.69 an hour. Minimum rates for painters and paperhangers in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rates*	
	Painters	*Paperhangers*
Atlanta	$7.05	$7.30
Boston	7.21	—
Chicago	8.28	8.28
Cincinnati	7.93	7.93
Cleveland	8.71	8.71
Detroit	7.95	7.95
Houston	6.11	6.36
Newark	6.60	—
New Orleans	5.38	5.38
Philadephia	6.92	7.14
Richmond	4.65	4.65
Salt Lake City	5.77	6.02
San Diego	7.43	7.93
Spokane	6.78	6.78

Their work often requires painters and paperhangers to stand for long periods of time, to climb, and to bend. A painter must have strong arms because much of the work is done with arms raised overhead. Painters and paperhangers risk injury from slips or falls off ladders and scaffolds. Painters on outside jobs lose some worktime due to bad weather.

A large proportion of painters and paperhangers are members of the International Brotherhood of Painters and Allied Trades. A few are members of other unions.

Sources of Additional Information

For details about painting and paperhanging apprenticeships or other work opportunities in these trades, contact local painting and decorating contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service can supply information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of painters and paperhangers may be obtained from:

International Brotherhood of Painters and Allied Trades, 1925 K St. NW., Washington, D.C. 20006.

Painting and Decorating Contractors Association of America, 2625 West Peterson Ave., Chicago, Ill. 60605.

PLASTERERS

(D.O.T. 842.381 and .781)

Nature of the Work

Plasterers finish interior walls and ceilings with plaster coatings that form fire-resistant and relatively sound-proof surfaces; they apply durable cement plasters or stucco to exterior surfaces. Plasterers also cast ornamental designs in plaster.

In interior work, these craftsmen usually apply three distinct coats of plaster—scratch, brown, and finish. They apply an initial or scratch coat directly to either metal or gypsum lath (backing to which plaster readily adheres) and then scratch this coat with a special raking tool before it hardens. The raking helps the next coat stick. When the plaster has set sufficiently, the brown coat or second layer of plaster is applied. Plasterers straighten and float this second layer with various plastering tools to prepare the surfaces for final finishing. The finish coat, usually a white lime mixture, is a thin covering that plasterers must apply quickly and finish smoothly with trowel, brush, and water. Instead of a smooth coat they often make a variety of decorative textures, such as swirl, stipple (dots), and sand finishes, by floating or skip troweling.

In exterior cement plaster or stucco work plasterers apply an initial or scratch coat to wire lath in the same way as they plaster interior surfaces. The finish coat is usually a mixture of white cement and sand or another finish material. Marble or gravel chips, for example, may be

imbedded into the soft plaster to form a textured surface.

Plasterers sometimes do complex decorative and ornamental work. For example, they may mold intricate designs for the walls and ceilings of public buildings. Plasterers who do this work must follow blueprints and other specifications furnished by architects.

Plasterers use many special tools. They hold the plaster mixture on a hawk (a light metal plate with a handle) and apply the wet mixture with a trowel. Smoothing and finishing is done with straightedges, beveledges, rods, floats, and other handtools. They also may use spray machines to apply plaster on both base and finish coats.

Apprentices work directly with journeymen to acquire their craft skills. Laborers (hod carriers) mix and carry materials for plasterers. They also set up scaffolding.

Places of Employment

Plasterers—who numbered about 30,000 in 1972—worked mostly on new construction. Many also do alteration work, particularly where special architectural and lighting effects are part of the building modernization. Some plasterers repair older buildings.

Training, Other Qualifications, and Advancement

Most training authorities recommend completion of an apprenticeship as the best way to learn plastering. However, many beginners have learned the trade by working as helpers or laborers, observing, and being taught by experienced plasterers.

Apprentices generally must be 17 to 25 years old but this requirement may be waived for veterans. Good physical condition and manual dexterity are important assets.

Apprenticeship programs generally consist of 3 or 4 years of on-the-job training, in addition to at least 144 hours of annual classroom instuction in drafting, blueprint reading, and mathematics for layout work.

Plasterers may advance to foreman, superintendent, or estimator for a plastering contractor. Many plasterers are self-employed.

Employment Outlook

Employment of plasterers is expected to increase slowly through the mid-1980's. Most job openings will result from the need to replace experienced workers who retire, die, or transfer to other occupations.

More plasterers will be needed because of rising construction activity. The greater use of curved surfaces, plaster ceilings, and one-coat veneer plasters will also add to the demand for these craftsmen.

Earnings and Working Conditions

Union minimum rates for plasterers in large cities averaged $7.45 an hour in 1972, compared with $7.69 for all building trades journeymen. Hourly rates for plasterers in 14 of these cities, selected to show how wages differ among various areas, appear in the accompanying tabulation.

City	*Hourly rate*
Birmingham	$ 6.32
Charlotte	5.10
Chicago	8.40
Cleveland	10.41
Dayton	8.45
Detroit	8.80
Grand Rapids	7.47
Little Rock	6.49
Madison	7.70
New Haven	8.52
New Orleans	6.15
Philadelphia	8.52
Sacramento	6.90
Spokane	7.00

Plastering requires considerable standing, stooping, and lifting. Plasterers work outdoors when applying stucco but most jobs are indoors.

A large proportion of plasterers are members of unions. They are represented by either the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For information about apprenticeships or other work opportunities in the trade, contact local plastering contractors; locals of the unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

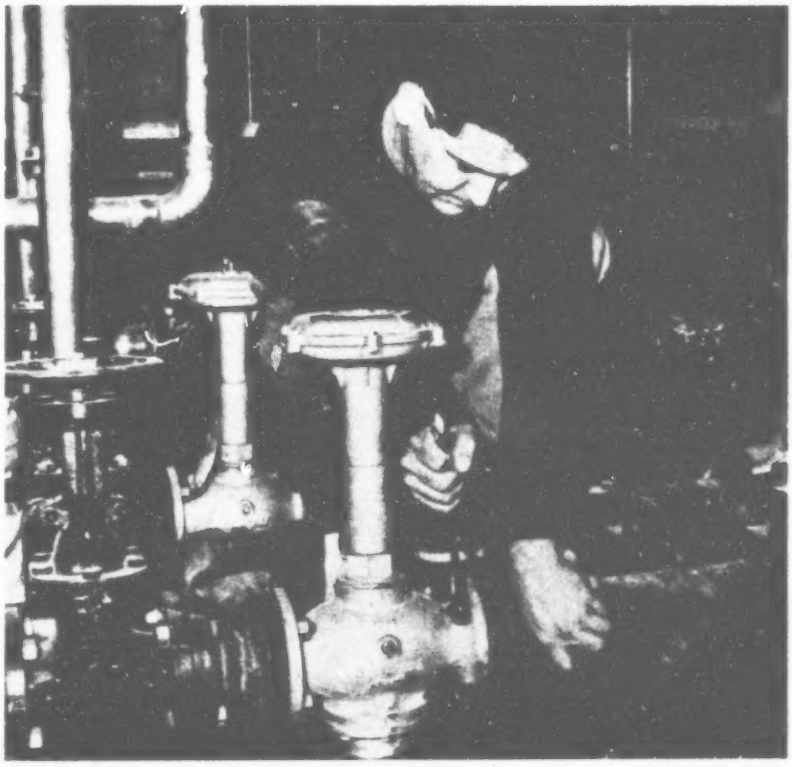
General information about the work of plasterers may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

International Association of Wall and Ceiling Contractors, 1775 Church St. NW., Washington, D.C. 20036. 20036.

International Council for Lathing and Plastering, 221 North LaSalle St., Chicago, Ill. 60601.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.



PLUMBERS AND PIPEFITTERS

(D.O.T. 862.381)

Nature of the Work

Plumbers and pipefitters install pipe systems that carry water, steam, air, or other liquids or gases. They also alter and repair existing pipe systems and install plumbing fixtures, appliances, and heating and refrigeration units.

Although plumbing and pipefitting are sometimes considered to be a single trade, journeymen can specialize in either craft. Plumbers install water, gas, and waste disposal systems in homes, schools, factories, and other buildings. Plumbers initially "rough in" (install) the pipe system as the building progresses; during the final construction stages they install the heating and air conditioning units and connect radiators, water heaters, and plumbing fixtures such as bathtubs and sinks. Pipefitters install both high- and low-pressure pipes that carry hot water, steam, and other liquids and gases. For example, pipefitters install the complex pipe systems in oil refineries and chemical processing plants.

Some plumbers and pipefitters specialize in gas, steam, or sprinkler fitting. Gas fitters install and maintain the fittings and extensions that connect gas line mains with the lines leading to homes. Steamfitters assemble and install steam or hot water systems for commercial and industrial uses. Sprinkler fitters install and maintain the piping for fire extinguishing systems.

Plumbers and pipefitters use wrenches, reamers, drills, braces and bits, hammers, chisels, saws, and other handtools. Power machines often are used to cut, bend, and thread pipes. Hand-operated hydraulic pipe benders are also used. In addition, plumbers and pipefitters use gas or acetylene torches and welding, soldering, and brazing equipment in their work.

Places of Employment

Most plumbers and pipefitters—who numbered about 400,000 in 1972—work for plumbing and pipefitting contractors engaged in new construction activity, and work mainly at the construction site. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers install and maintain pipe systems for government agencies and public utilities, and some work on the construction of ships and aircraft. Others do maintenance work in industrial and commercial buildings. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-

processing industries where manufacturing operations include the processing of liquids and gases through pipes.

Training, Other Qualifications, and Advancement

Most training authorities recommend a formal 5-year apprenticeship for plumbers or for pipefitters as the best way to learn all aspects of these trades. A large number of plumbers and pipefitters, however, acquire skills by working for several years with craftsmen, and observing and receiving instruction from them. Many gain some knowledge of their trade by taking trade or correspondence school courses.

Apprentice applicants generally are required to be 16 to 25 years old and in good physical condition. A high school education or its equivalent, including courses in mathematics, physics, and chemistry, is generally recommended. Applicants may be given tests to determine whether they have the mechanical aptitude required in these trades.

Most apprentice training programs for plumbers and pipefitters are conducted under written agreements between the apprentices and local apprenticeship committees, composed of union and management representatives, who supervise the training. These committees determine the need for apprentices in the locality, establish minimum training standards and, if necessary, schedule a rotating work program. Programs are designed to give apprentices diversified training by having them work for several plumbing or pipefitting contractors.

The apprenticeship program for plumbers or for pipefitters usually consists of 5 years of on-the-job training, in addition to at least 144 hours of related classroom instruction annually. On the job, the plumber or pipefitter apprentice learns to use the tools, machines, equipment, and materials of the trade. Classroom instruction covers subjects such as drafting and blueprint reading, mathematics applicable to layout work, applied physics and chemistry, and local building codes and regulations.

Hourly wage rates of apprentices usually start at 40 to 50 percent of the journeyman rate and increase every 6 months, until a rate of 85 to 90 percent is reached during the last period of the apprenticeship. To obtain a journeyman's license, which some communities require, an apprentice must pass a special examination to demonstrate knowledge of the trade and of the local building codes.

Some plumbers and pipefitters may become foremen for plumbing and pipefitting contractors. Many go into business for themselves. As they expand their activities, they may employ other workers and become contractors. In most localities, contractors are required to obtain a master plumber's license.

Employment Outlook

Employment of plumbers and pipefitters is expected to grow moderately through the mid-1980's. Thousands of job openings are expected because of employment growth and the need to replace plumbers and pipefitters who retire, die, or stop working for other reasons.

Employment is expected to grow mainly as a result of the anticipated large increase in construction activity. Furthermore, plumbing will become more important in many types of construction. For example, the trend to more bathrooms per home is likely to continue, and many homes will have air-conditioning and appliances such as washing machines, gas dryers, and kitchen waste disposal equipment. Industries such as chemical and petroleum refining, which use extensive pipework in their processing activities, are expected to expand their facilities, thus creating additional jobs for plumbers and pipefitters. Maintenance, repair, and modernization of existing plumbing or piping systems also will create employment opportunities.

Earnings and Working Conditions

Union minimum wage rates for plumbers and for pipefitters in 68 large cities averaged $8.15 and $8.14 an hour, respectively in 1972, compared with $7.69 an hour for all building trades journeymen. Average minimum rates for plumbers and pipefitters in 12 of these cities, selected to show how wage rates differ among various areas of the country, appear in the accompanying tabulation. Annual earnings of workers in these fields are among the highest in the building trades because plumbing and pipefitting are affected less by seasonal factors than are most other building trades.

City	Hourly rates	
	Plumbers	*Pipefitters*
Atlanta	$7.85	$7.85
Boston	9.05	9.26
Columbus	9.62	9.62
Dallas	7.20	7.20
Kansas City	8.65	8.02
Memphis	7.44	7.17
Newark	8.54	8.86
Phoenix	7.74	7.74
Pittsburgh	8.66	8.69
Sacramento	7.58	7.58
Shreveport	6.51	6.51
Tulsa	7.51	7.51

Plumbing and pipefitting work is active and sometimes strenuous. These craftsmen frequently must stand for long periods and occasionally work in cramped or uncomfortable positions. They risk the danger of falls from ladders, cuts from sharp tools, and burns from hot pipes. The injury rate for

employees of plumbing, heating, and air-conditioning contractors in the construction industry has been lower than that for contract construction as a whole, but higher than the average for production workers in manufacturing.

Many plumbers and pipefitters are members of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada.

Sources of Additional Information

For information about plumber or pipefitter apprenticeships or work opportunities in these trades, contact local plumbing, heating, and air-conditioning contractors; a local union of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of plumbers, pipefitters, and sprinkler fitters may be obtained from:

National Association of Plumbing-Heating-Cooling Contractors, 1016 20th St. NW., Washington, D.C. 20036.

National Automatic Sprinkler and Fire Control Association, 277 Park Ave., New York, N.Y. 10007.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, 901 Massachusetts Ave. NW., Washington, D.C. 20001.

ROOFERS

(D.O.T. 804.281, 843.884, and 866.381)

Nature of the Work

Roofers apply composition roofing and other materials, such as metal and tile, to the roofs of buildings. They also waterproof and dampproof walls and other building surfaces.

To apply composition roofing, roofers first place strips of asphalt or tarred felt over the entire surface. They then apply a coating of tar, asphalt, or other tarlike bituminous material. This process is repeated until at least three layers of felt are in place. Finally, they apply an asphalt or gravel-and-tar surfacing or a smooth surface asphalt to protect the roofing materials from weather.

Other types of composition roofing, such as roll roofing and asphalt shingles, are overlapped and fastened to the roof with nails or asphalt cement. If necessary, material is cut to fit corners, pipes, and chimneys. Wherever two roof surfaces intersect, roofers cement or nail flashing (strips of felt or metal) to make the joints watertight.

Roofers also use metal, tile, and slate. They build metal roofs by soldering together metal sheets which are nailed to the wood sheathing. To install tile and slate roofs, they place a covering of roofing felt over the wood sheathing, punch holes in the slate or tile, and nail it to the sheathing. Each row of slate or tile overlaps the preceding row. Finally, roofers cover exposed nailheads with cement to prevent rust and water leakage. They use handtools such as hammers, roofing knives, mops, and calking guns.

Roofers also waterproof and dampproof masonry, concrete walls, or swimming pools and tanks. To prepare surfaces for waterproofing, they remove rough spots with a hammer and chisel or rubbing brick before applying a coat of liquid waterproofing compound with a brush. They also may paint or spray surfaces with a waterproofing material or nail waterproofing fabric to surfaces. When dampproofing, they usually spray a coating of tar or asphalt on interior or exterior surfaces.

Places of Employment

About 80,000 roofers were employed in 1972. Most worked for roofing contractors in construction or repair jobs. Some worked for businesses and government agencies that do their own construction and repair work. A few roofers were self-employed.

Training, Other Qualifications, and Advancement

Most training authorities recommend completion of a 3-year apprenticeship program as the best way to learn this trade. Some workers, however, acquire roofing skills informally, by working as helpers or handymen, observing or being taught by experienced roofers.

Apprenticeship applicants usually must be 18 to 30 years old; however, exceptions may be made for veterans. A high school education or its equivalent is desirable. Good physical condition and a good sense of balance are important assets. The 3-year apprenticeship program generally consists of a minimum of 1,400 hours of on-the-job training annually, in addition to 144 hours of classroom instruction in subjects such as blueprint reading and mathematics applicable to layout work.

Apprentices usually start at 65 percent of the journeyman rate. They receive increases periodically

and rise to 90 percent of the journeyman rate in the final 6 months of the training period.

Roofers may advance to foreman and to superintendent for a roofing contractor. Also, they may enter business for themselves and hire other roofers.

Employment Outlook

Employment of roofers is expected to increase rapidly through the mid-1980's. In addition to jobs from employment growth, some openings will arise because of the need to replace experienced roofers who retire, die, or stop working for other reasons.

Employment of roofers is expected to increase mainly because of the expected rapid increase in construction activity. New construction and repairs on existing structures will provide most of the work for these craftsmen. Dampproofing and waterproofing, however, are expected to provide an increasing proportion of roofers' work.

Earnings and Working Conditions

Union minimum wage rates for composition roofers in 68 large cities averaged $7.37 an hour in 1972. For slate and tile roofers, the average was $7.22. By comparison, the average for all journeymen in the building trades was $7.69 an hour. Hourly rates for roofers in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rates*	
	Composition	*Slate and tile*
Atlanta	$5.65	$5.90
Boston	8.00	8.00
Cleveland	9.76	9.76
Dallas	6.18	6.33
Detroit	8.27	9.02
Kansas City	7.16	7.16
Milwaukee	7.26	7.41
New Orleans	5.65	5.65
New York City	8.00	8.40
Norfolk	4.10	4.10
Pittsburgh	9.01	9.01
San Diego	6.89	6.89
Spokane	6.60	6.60
Syracuse	7.95	7.95

Roofers' work, like that of other building tradesmen, is sometimes strenuous. It involves a lot of standing, as well as climbing, bending, and squatting. These craftsmen risk injuries from slips or falls from scaffolds or roofs, and may have to work outdoors in all types of weather, particularly when making repairs. Roofing work may be especially hot during the warmer months.

Most roofers are members of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association

Sources of Additional Information

For information about roofing apprenticeships or work opportunities in this trade, contact local roofing contractors; a local of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Local offices of the State employment services may provide information about the Manpower Development and Training Act, apprenticeship, and other training opportunities.

General information about the work of roofers may be obtained from:

National Roofing Contractors Association, 1515 North Harlem Ave., Oak Park, Ill. 60302.

SHEET-METAL WORKERS

(D.O.T. 804.281 and .884)

Nature of the Work

Sheet-metal workers engaged in construction-related work fabricate and install ducts for ventilating, air-conditioning, and heating systems. They fabricate and install many other products from sheet metal, such as roofing, siding, and neon signs. Sheet-metal workers should not be confused with assembly-line factory workers who also make sheet-metal products but can perform only a few operations.

In heating and air conditioning duct work, sheet-metal workers plan the job to determine the size and type of metal needed before cutting it with hand snips, power-driven shears, and other tools. They shape the metal with machines, hammers, and anvils, then weld, bolt, rivet, solder, or cement the seams and joints. Ready-made ducts require little fabrication at the work site. To install ducts, components are fitted together, hangers and braces installed for support, and joints connected and soldered or welded. Some sheet-metal workers specialize in shopwork or on-site installation; others do both.

Places of Employment

Sheet-metal workers—who numbered about 65,000 in 1972—are employed mainly by firms that fabricate and install heating, refrigeration, and air-conditioning equipment, and by contractors engaged in residential, industrial, and commercial building. Many sheet-metal workers are employed by government agencies or businesses that do their own construction and alteration work. Others are self-employed.

In addition to construction-related work, thousands of skilled sheet-metal workers are employed in the railroad, aircraft, and shipbuilding industries. Many others work in small shops that manufacture specialty products, such as custom kitchen equipment for hotels and restaurants. Firms that make blowers, exhausts, electrical equipment, food products machinery, and turbines also employ skilled sheet-metal workers.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn the sheet-metal trade. Some sheet-metal workers, however, have acquired skills by working as helpers or handymen, observing and being taught by experienced craftsmen. Many of these persons take correspondence or trade school courses to gain additional knowledge.

Apprenticeship applicants generally must be 18 to 25 years old, but special consideration may be given for military service. A high school education or its equivalent is required. Good physical condition and mechanical aptitude are necessary.

The apprenticeship program usually consists of 4 years of on-the-job training, in addition to related classroom instruction. On the job, apprentices learn to use the tools, machines, equipment, and materials of the trade. Classroom instruction covers subjects such as drafting, blueprint reading, and mathematics applicable to layout work. In addition, apprentices learn the relationship between sheet-metal work and other building trades.

Sheet-metal apprentices generally start at 45 percent of the journeyman rate and increase periodically until 80 percent of the journeyman rate is reached during the final portion of the training period.

Sheet-metal workers in construction may advance to foreman, superintendent of large projects, or go into business as sheet-metal contractors. Experienced workers in this trade have more job mobility than many other building trades workers because they can transfer their skills to nonconstruction industries.

Employment Outlook

Employment of sheet-metal workers is expected to increase moderately through the mid-1970's. In addition to jobs from employment growth, many openings will arise as experienced sheet-metal workers retire, die, or stop working for other reasons.

The increase in employment of sheet-metal workers is expected mainly because of the anticipated large expansion in residential, commercial, and industrial construction. More of these skilled craftsmen will be needed to install air-conditioning and heating duct work and other sheet-metal products in new houses, stores, offices and other buildings. Moreover, air-conditioning systems are expected to be installed in a greater number of older buildings.

Earnings and Working Conditions

Union minimum wage rates for sheet-metal workers in 68 large cities averaged $8.09 an hour in 1972, compared with $7.69 an hour for all building trades journeymen. Minimum rates for sheet-metal workers in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	*Hourly rate*
Albuquerque	$ 6.78
Boston	8.43
Buffalo	8.50
Charlotte	5.65
Cincinnati	8.28
Cleveland	9.71
Des Moines	7.50
Houston	6.99
Kansas City	8.45
Pittsburgh	8.48
Sacramento	7.40
San Diego	8.13
Tampa	7.01
Washington, D.C.	8.03

Many sheet-metal workers spend considerable time at the construction site, working either indoors or outdoors. Others work primarily in shops doing fabricating and layout work.

When installing gutters and skylights, they work high above ground. When installing ventilation and air-conditioning systems, they may work in awkward and cramped positions. Sheet-metal workers risk cuts and burns from materials and tools.

A large proportion of sheet-metal workers are members of the Sheet Metal Workers' International Association.

Sources of Additional Information

For more information about sheet-metal apprenticeships or other work opportunities, contact local sheet-metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the Sheet Metal Workers' International Association; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about sheet-metal workers may be obtained from:

Sheet Metal and Air Conditioning Contractors' National Association, Inc., 1611 North Kent St., Arlington, Va. 22209.

Sheet Metal Workers' International Association, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

STONEMASONS

(D.O.T. 861.781)

Nature of the Work

Stonemasons who build the stone exteriors of structures use two types of stones—natural cut, such as marble, granite, and limestone; and artificial stone made from cement, marble chips, or other masonry materials. Because stone is expensive, these craftsmen work mostly on high-cost buildings, such as offices, hotels, and churches.

Stonemasons often work from a set of drawings in which each stone has been numbered for identification. Helpers locate and bring the pieces needed to the masons.

A derrickman using a hoist lifts large pieces into place. Masons set the stone in mortar and move it into position with a mallet, hammer, or crowbar. They align stones with a plumb line and finish the joints with a pointing trowel. When necessary, they weld or fasten the stone to supports with metal ties or anchors.

To cut various shapes and sizes, craftsmen find the grain of each piece of stone and use a stonemason's hammer to strike it along a predetermined line. Valuable pieces often are cut with an abrasive saw.

Stonemasons also do veneer work, in which cut stone is applied in various patterns. In one specialized branch of the trade known as alberene stone setting, masons set acid-resistant soap-stone linings for vats, tanks, and floors.

The principal handtools of the stonemason are trowels, heavy hammers, wooden or hard rubber mallets, and chisels. For rapid cutting, pneumatic tools are used. They use special power tools to smooth the surface of large stones.

Places of Employment

Most stonemasons work in large urban areas for stonemasonry and bricklaying contractors and general construction contractors. A few also work for government agencies or business establishments that handle their own construction and alteration work. In areas that have no stonemasons, bricklayers often perform this work.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 3-year apprenticeship training program in addition to related classroom instruction as the best way to learn this trade. Many masons, however, have picked up the trade by working as helpers, observing, and being taught by experienced masons.

Apprenticeship applicants generally must be 17 to 24 years old. A high school education or its equivalent is desirable. Good physical condition is important because the work can be strenuous.

Stonemasons may advance to jobs as foremen. They also may become cost estimators for stonemasonry contractors. A few start their own contracting business.

Employment Outlook

Employment of stonemasons is expected to have little change through the mid-1980's, despite the anticipated large expansion in construction activity. Stone is being used less frequently because modern architecture emphasizes simple lines, little ornamentation, and large windows. However, a small number of job openings for new workers will arise as experienced stonemasons retire, die, or change occupations.

Earnings and Working Conditions

Union minimum wage rates for stonemasons in 68 large cities averaged $7.87 an hour in 1972, compared with $7.69 for all journeymen in the building trades. Minimum rates for stonemasons in 14 of these cities, selected to show how wages differ among various areas of the country, appear in the accompanying tabulation.

City	Hourly rate
Albuquerque	$ 6.29
Birmingham	6.65
Boston	8.45
Chicago	8.90
Des Moines	7.98
Houston	7.20
Jacksonville	6.65
Knoxville	7.07
Los Angeles	8.00
Phoenix	8.85
Pittsburgh	9.16
Scranton	8.43
Seattle	7.65
Washington, D.C.	8.60

Since most stonemasonry is done outdoors, working hours are often lost because of bad weather. The work is active and sometimes strenuous, as it involves heavy lifting.

A large proportion of stonemasons are members of the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For further information about apprenticeships for stonemasons or other work opportunities in this trade, contact local bricklaying or stonemasonry contractors; a local of the Bricklayers, Masons and Plasterers' International Union of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may have information about apprenticeship and other training opportunities.

General information about the work of stonemasons may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

STRUCTURAL-, ORNAMENTAL-, AND REINFORCING-IRON-WORKERS, RIGGERS, AND MACHINE MOVERS

(D.O.T. 801.281, .381, .781, .884; 809.381, .781, .884; and 869.883)

Nature of the Work

Ironworkers erect steel framework and other metal parts in buildings, bridges, and other structures. They also rig heavy construction machinery (prepare it for moving) and deliver the machinery to new sites. In addition, ironworkers make alterations, such as installing steel stairs or adding window guards to buildings, and do repair work, such as replacing metal bridge parts.

Ironworkers comprise four related trades—structural ironworkers, riggers and machine movers, ornamental-ironworkers, and reinforcing-ironworkers (rodmen). Many craftmen are skilled in two or more of these trades.

Structural-ironworkers (D.O.T. 809.381) erect the steel framework of bridges, buildings, and other structures such as storage tanks. They also install floor decking and the doors and frames of bank vaults. In erecting steel framework, they push, pull, or pry steel beams and girders into proper position. Next, they temporarily connect all steel members with bolts, use plumb bobs and levels to align the structure, and then weld or bolt the pieces. In a large building, ironworkers generally specialize in a particular operation, such as welding or bolting.

Riggers and machine movers (D.O.T. 869.883) set up and rig the hoisting equipment used to erect and dismantle structural steel frames. These skilled workers also move heavy construction machinery and equipment. They study the size, shape, and weight of the object to be moved; choose lines and cables to support the load; and select points of attachment that will provide a safe and secure hold on the load. Next, they attach the lifting device to both the hoisting equipment and the item to be moved, and direct the load into position by giving hand signals and other directions to the hoisting machine operator. In many instances, special rigging equipment must be built on the job to move unusually shaped materials and machines. This work requires a knowledge of hoisting equipment and lifting devices.

Ornamental-ironworkers (D.O.T. 809.381) install metal stairways, catwalks, floor gratings, ladders, and window frames. They also install lampposts, fences, and decorative ironwork. In addition, they work with prefabricated aluminum, brass, and bronze items. Examples are recently-developed ornamental building facades which are bolted or welded to a building.

Reinforcing-ironworkers (rodmen) (D.O.T. 801.884) set steel rods or bars in concrete forms to reinforce the concrete. Rodmen place the steel bars on suitable supports in the concrete form and tie the bars together at intersections so that each bar receives its intended structural load. The bars are placed in the form according to blueprints, specifications, or verbal instruction. Rodmen use steel pliers and other tying tools to wire the rods securely in place. Some concrete is reinforced with a coarse mesh made of welded wire (usually 6- by 6-inch grids). When using mesh, rodmen measure the surface to be covered, cut and bend the mesh to the desired shape, and place it over the area to be reinforced. While the concrete crew pours the slab, rodmen use hooked rods to

position the wire mesh in the freshly poured mixture.

Places of Employment

About 95,000 structural- and ornamental-ironworkers were employed in 1972. Thousands of additional workers were employed as riggers, machine movers, and reinforcing-ironworkers.

Most of these craftsmen are employed by general contractors on large building projects, steel-erection contractors, or ornamental-iron contractors. Many are employed by large steel companies or their subsidiaries engaged in the construction of bridges, dams, and large buildings. Some work for government agencies, public utilities, or large industrial establishments that do their own construc-work. A few are self-employed.

Training and Other Qualifications

Most training authorities recommend the completion of a 3-year apprenticeship as the best way to learn these trades. Apprenticeship applicants must be 18 to 30 years old. Good physical condition is required and a high school education or its equivalent is desirable.

The apprenticeship program for ironworkers usually consists of 3 years of on-the-job training, given either by the foreman or an experienced journeyman, and a minimum of 144 hours a year of classroom instruction in subjects such as drafting, blueprint reading, and mathematics applicable to layout work.

Hourly wage rates for apprentices start at 60 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of the apprenticeship. In some localities, the starting rate may be as high as 75 percent of the journeyman rate.

Employment Outlook

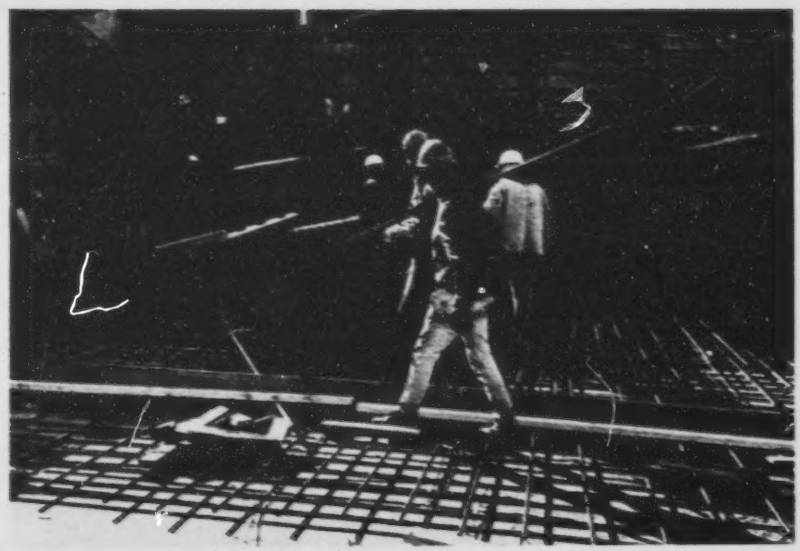
Employment of ironworkers is expected to increase moderately through the mid-1980's. Besides jobs resulting from employment growth, many openings will result from the need to replace experienced journeymen who transfer to other fields of work, retire, or die.

The rise in ironworker employment is expected principally because of the anticipated large increase in construction activity. The growing use of structural steel in buildings will create a need for more structural-ironworkers. Work opportunities for ornamental-ironworkers also will result from the growing popularity of ornamental panels for large buildings, and of metal frames to hold large glass installations. More riggers and machine movers will be needed to handle the increasing amount of heavy construction machinery. The growing demand for prestressed concrete will create additional job opportunities for reinforcing-ironworkers.

Earnings and Working Conditions

Union minimum wage rates for structural-ironworkers and rodmen in 68 large cities averaged $7.79 and $7.73 an hour, respectively in 1972, compared with $7.69 for all building trades journeymen. Average minimum hourly rates for ironworkers and rodmen in 14 of these cities, selected to show how wages differ among various areas, appear in the accompanying tabulation.

City	Hourly rates	
	Structural-Ironworkers	Rodmen
Atlanta	$6.80	$6.80
Baltimore	7.76	7.76
Boston	7.89	7.89
Chicago	9.21	9.21
Cleveland	9.10	9.10
Denver	6.75	6.75
Detroit	8.00	7.45



Los Angeles	8.38	8.55
Lubbock	5.08	5.08
Minn.-St. Paul	7.55	7.55
Philadelphia	8.09	9.03
St. Louis	7.98	7.98
San Diego	8.38	8.34
Tulsa	7.44	7.44

Since materials used in ironworking trades are heavy and bulky, above-average physical strength is necessary. Agility and a good sense of balance also are required in order to work at great heights and on narrow footings. Although many ironworkers risk injury from falls, safety devices such as nets and scaffolding have reduced accident frequency.

Ironwork often involves considerable travel because demand is insufficient to keep local crews constantly employed. Consequently, workers must be imported to handle occasional large construction projects. Large contractors may keep a small crew continually employed by moving them from job to job.

Many workers in these trades are members of the International Association of Bridge, Structural and Ornamental Iron Workers.

Sources of Additional Information

For more information on apprenticeships or other work opportunities, contact local general contractors; a local of the International Association of Bridge, Structural and Ornamental Iron Workers; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency of the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about ironworkers may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

OCCUPATIONS IN TRANSPORTATION ACTIVITIES

Transportation offers a wide range of career opportunities. Jobs in air, rail, highway, and water transportation vary from those that require only a grade school education to technical positions that require at least a college degree.

Although this field has many kinds of jobs, most employees drive trucks and buses, fly airliners, operate trains and ships, and keep this equipment in good working condition. Some examples of these workers are locomotive engineers, airplane pilots, and truck drivers; and track maintenance workers, aircraft mechanics, and truck mechanics. Employees who provide services for customers, such as flight attendants and reservation agents, account for most of the remaining transportation jobs.

As our economy expands and population grows, demand for freight and passenger service will rise, and more transportation workers will be hired. Employment trends, however, will vary by type of business. Employment in most air and highway transportation jobs will increase, while employment in the merchant marine and many railroad jobs will decline. Even in declining occupations, however, new workers will be hired to replace those who retire, die, or transfer to other fields.

The transportation occupations mentioned in this introduction, as well as many more, are described in detail in the sections which follow.

AIR TRANSPORTATION OCCUPATIONS

More than 500 thousand workers helped operate the Nation's fleet of civilian aircraft in 1972. Some, like pilots, flew on them as crewmembers, while mechanics made sure all equipment operated properly. Others took passenger reservations and sold tickets. Still others, like air traffic controllers, helped safeguard the planes.

Air transportation offers excellent opportunities for young persons with varied types of skills and training. Working conditions are generally good and the pay is fairly high. Many employees will enjoy traveling and meeting new and interesting people.

Through the mid-1980's, employment in air transportation occupations as a whole is expected to grow as the number of planes flown increases. In addition to those employed because of this growth, many new employees will be hired to replace those who retire, die, or stop working for other reasons.

The individual statements that follow cover pilots and copilots, flight engineers, aircraft mechanics, airline dispatchers, air traffic controllers, ground radio operators and teletypists, and traffic agents.

AIR TRAFFIC CONTROLLERS

(D.O.T. 193.168)

Nature of the Work

Air traffic controllers are the guardians of the airways. They coordinate flights to prevent accidents and minimize delays in takeoffs and landings. Some regulate airport traffic; others regulate flights between airports.

Airport traffic controllers work in a tower near the runway to keep track of planes that are on the ground and in the air nearby. They radio pilots to give them permission to taxi, take off, or land. To assure safe conditions, they must consider many factors including weather, and the number, size, and speed of the planes in the area. They also must keep track of positions of planes both on the ground and in the air to control several aircraft simultaneously.

After a plane takes off, airport controllers notify air route controllers to take charge. Route controllers communicate with pilots by radio and use radar and other electronic equipment to help keep planes on course. They also warn pilots about nearby planes and other possible hazards. Each route controller is assigned a certain amount of airspace. One, for example, might be responsible for all planes that are 30 to 100 miles north of the airport and flying between 6,000 and 18,000 feet. As the flight progresses, one air route controller after another takes charge until the planes have safely arrived at their destinations and airport traffic controllers are again in charge.

Places of Employment

Almost all of the 20,000 air traffic controllers who worked for the Federal Aviation Administration

Traffic controllers identify airplanes by radar.

(FAA) in 1972 were men. Almost all worked at major airports and air route traffic control centers located near large cities. A few were assigned to control towers and centers outside the United States.

Training, Other Qualifications, and Advancement

Air traffic controller trainees are selected through the competitive Federal Civil Service System. Applicants must be less than 31 years old and must pass a written test that measures their ability to learn and perform controller's duties. In addition, applicants must have 3 years of progressively responsible work experience that demonstrates potential for learning and performing air traffic control work, or four years of college or a combination of both. Applicants must be in excellent health, have vision correctable to 20/20, and must be able to speak clearly and precisely.

Successful applicants receive a combination of on-the-job and formal training to learn the fundamentals of the airway system, Federal aviation regulations, controller equipment, and aircraft performance characteristics. All receive intensive training in simulators at the FAA Academy in Oklahoma City. It usually takes two to three years to become a fully-qualified controller. Each year controllers must pass a physical and twice a year must pass a job performance examination.

Controllers can transfer to jobs at different locations and advance to the job of chief controller. Some advance to more responsible management jobs in air traffic control and a few to top administrative jobs in the FAA.

Employment Outlook

Employment of air traffic controllers is expected to increase rapidly through the mid-1980's. In addition to jobs that result from growth, many openings will arise as experienced controllers retire, die or transfer to other jobs.

As the number of aircraft increases, the skyways will become more congested. To prevent collisions, the FAA has created spaces, near certain airports and above certain altitudes which require all pilots to receive directions from air traffic controllers. If, as expected, the number and size of these spaces are expanded, more controllers will be needed despite the greater use of new, automated control equipment.

Under the provisions of a new labor contract, controllers may now retire with a pension after working 20 years. Many eligible employees are expected to retire over the next few years and create an unusually large number of openings. However, because the number of applicants is large, competition is expected to be severe.

Earnings and Working Conditions

In 1972, experienced air traffic controllers earned between $14,000 and $19,700 a year. Depending on length of service, they receive 13 to 26 days of paid vacation and 13 days of paid sick leave each year, life insurance, health benefits, and a more liberal retirement program than other Federal employees.

Controllers work a basic 40-hour week; however, they may work additional hours, for which they receive overtime pay or equal time off. Because control towers and centers must be operated 24 hours a day, 7 days a week, controllers are assigned to night shifts on a rotating basis.

Air traffic controllers work under great stress. They must keep track of several planes at the same time and make certain all pilots receive correct instructions.

Many controllers belong to the Professional Air Traffic Controllers Organization.

Sources of Additional Information

A pamphlet providing general information about controllers is available from any U.S. Civil Service Commission office. Addresses of these offices are available at all post offices.

Inquiries about job opportunities should be addressed to the personnel department of the nearest FAA regional office. Addresses of regional offices are available from:

Personnel Operations Division, Federal Aviation Administration, 800 Independence Ave. SW., Washington, D.C. 20591.

AIRCRAFT MECHANICS

(D.O.T. 621.281)

Nature of the Work

Aircraft mechanics keep complicated jet airliners as well as small aircraft in good operating condition. These skilled craftsmen perform preventive maintenance and make repairs. They also make inspections required by the Federal Aviation Administration (FAA).

Many aircraft mechanics do routine preventive maintenance. They change engine oil, grease wheel bearings, replace sparkplugs, and make other minor adjustments. Other mechanics specialize in engine work. Periodically, planes are brought to maintenance shops for major repairs and for inspections required by the FAA. Mechanics may take engines apart, check the pieces for wear, and replace bearings or other parts as needed. Some mechanics work on

Mechanic works on airplane engine.

airframes. For example, they may measure the strength of control cables or check for cracks in the fuselage and wings. Still others specialize in maintaining aircraft instruments.

Aircraft mechanics occasionally make emergency repairs. After obtaining a description of the problem from the pilot, they locate and correct the faulty equipment. They must work quickly so that the plane can be placed back in service.

Mechanics use many different tools ranging from simple handtools such as screwdrivers and wrenches to power tools such as drills. They also use test equipment to locate flaws in parts, electrical shorts, and other problems.

Places of Employment

About 123,000 aircraft mechanics were employed in 1972. Over 40 percent were employed by airlines, and about 25 percent worked in aircraft manufacturing plants. About 20 percent worked for the Federal government. Most of the rest worked in small independent repair shops.

Most airline mechanics are employed in the larger cities on the main airline routes. Each airline usually has one main repair base near a large city for each type of airplane it operates. More than half of the airline mechanics work in New York, Miami, Chicago, Los Angeles, San Francisco, and Dallas. Many other mechanics work in small repair shops located at airports throughout the country.

Training, Other Qualifications, and Advancement

Most mechanics learn their trade primarily through informal on-the-job training or through formal apprenticeship programs. For aircraft mechanic trainee or apprentice jobs, employers prefer high school or trade school graduates between 20 and 30 years of age who are in good physical condition and who have had courses in mathematics, physics, chemistry, and machine shop. Experience in automobile repairs or other mechanical work also is helpful.

The larger airlines train apprentices in carefully planned 3- or 4-year programs of instruction and work experience. People who have aircraft mechanic experience in the Armed Forces usually are given credit towards the completion of apprenticeship. Many small shops do not have apprenticeship programs; new employees learn the trade by working with and observing experienced mechanics. Other mechanics prepare for the trade by graduating from an FAA approved mechanic school. Most of these schools have an 18- to 24-month program.

Aircraft mechanics must be able to do detailed work. Average strength and agility are needed for reaching, and climbing, and lifting parts and tools.

To complete inspections required by the FAA, a mechanic must be licensed by the FAA as an airframe mechanic, a powerplant mechanic, or both. Airframe mechanics are qualified to work on fuselages, wings and landing gear; powerplant mechanics are qualified to work on engines. A mechanic licensed for both the airframe and the powerplant can work on any part of the plane.

At least 18 months of work experience is required for an FAA airframe or powerplant license, and at least 30 months of experience working with both engines and airframes is required for an airframe and powerplant license. Applicants also must pass a written test and give a practical demonstration of their ability to do the work. Applicants who have graduated from a mechanic's school approved by the FAA do not need mechanic work experience to take the test for a license.

As aircraft mechanics gain experience, they can advance to more responsible jobs. The line of advancement is usually mechanic, lead mechanic (or crew chief), inspector, chief inspector, shop foreman, and maintenance supervisor. In airline companies, a few advance to executive positions. With additional business training, some may open their own repair shops.

Employment Outlook

The number of aircraft mechanics is expected to increase very rapidly through the mid-1980's. In addition to job openings that result from employment growth, many openings will arise as experienced mechanics transfer to other fields of work, retire, or die.

Employment is expected to grow as a result of a substantial increase in the number of aircraft in operation. Assuming no continued significant fuel shortage, increases in population, personal income, and business activity will spur the demand for more airliners and small planes used by businesses and individuals. Opportunities for aircraft mechanics in the Federal government will fluctuate with changes in defense spending.

Earnings and Working Conditions

In 1972, the starting pay for airline mechanics trainees was $4.19 an hour, and could reach $6.55 an hour for experienced mechanics according to union contracts. The hourly rate for experienced mechanics was about three-fourths higher than the average for nonsupervisory workers in all private industries, except farming.

As a rule, airline mechanics and their immediate families are entitled to a limited amount of free or reduced fare transportation on their company's flights. In addition, they may fly on other airlines at greatly reduced rates. Mechanics usually receive from 2 to 4 weeks of vacation with pay, depending on their length of service. They also receive paid sick leave, and retirement and medical benefits.

Mechanics usually work in hangars or in other indoor areas. However, when repairs must be made quickly, they may work outdoors. Mechanics sometimes must stand or lie in awkward positions when making repairs. Work areas are noisy when engines are being tested.

Mechanics employed by most major airlines are covered by union agreements. The principal unions in this field are the International Association of Machinists and Aerospace Workers and the Transport Workers Union of America. Some mechanics are represented by the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Sources of Additional Information

Information about jobs in a particular airline may be obtained by writing to the personnel manager of the company. Addresses of airline companies are available from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

For information on jobs in a particular area, contact local employers or the local office of the State employment service.

AIRLINE DISPATCHERS

(D.O.T. 912.168)

Nature of the Work and Places of Employment

Dispatchers (sometimes called flight superintendents) are employed by the airlines to coordinate airline flight schedules and to make sure that all regulations of the Federal Aviation Administration (FAA) and the airline company are observed. After checking on weather conditions, the dispatcher makes a preliminary decision as to whether a flight can leave safely and on time. If any change takes place from the scheduled departure time, the dispatcher must arrange for the passengers and crew to be notified.

In preparing for the flight, the dispatcher confers with the captain about the quantity of fuel the plane needs, the best route and altitude for its flight, and the alternate airports that may be used if bad weather prevents landing at the scheduled airport. The dispatcher and the captain must agree on all details of the flight before the plane is allowed to leave the airport. In some instances, the dispatcher also keeps records of matters involving the company, such as the availability of aircraft and equipment, the weight of cargo, the amount of time flown by each aircraft, and the number of hours flown by each crew member.

In 1972, airlines employed about 800 dispatchers and assistants. Most of them worked at large airports near metropolitan areas.

Training, Other Qualifications, and Advancement

Dispatchers are selected from employees having 5 to 10 years general experience with the company. They are required to have an FAA dispatcher certificate. To qualify, an applicant has to work at least a year under the supervision of a certified dispatcher or complete an FAA-approved dispatcher's course at a school or an airline training center. Applicants who do not have this schooling or

experience may qualify if they have spent 2 of the previous 3 years in air traffic control work, or in airline jobs such as dispatch clerk, assistant dispatcher, or radio operator, or in similar work in military service.

Applicants for an FAA dispatcher certificate must pass a written examination on subjects such as Federal aviation regulations, weather analysis, air-navigation facilities, radio procedures, and airport and airway traffic procedures. In an oral test, they also have to demonstrate ability to interpret weather maps and information, and familiarity with airline routes and navigational facilities. They must know all operating weight limitations, landing and cruising speeds, and other aircraft characteristics. Licensed dispatchers are checked periodically by their employers to make sure that they maintain the skills required by Federal regulations and the company. Airlines give qualified dispatchers additional training to keep them up to date on new flight procedures and the characteristics of new aircraft.

For assistant dispatcher jobs, which may not require certification, airlines seek persons who have at least 2 years of college or who have worked an equivalent amount of time in some phase of air transportation, such as the dispatch clerks in ground operations. Preference is given to college graduates who have had courses in mathematics, physics, and related subjects. Some experience in flying, meteorology, or business administration also is helpful.

Employment Outlook

The number of workers in this very small occupation is not expected to change much through the mid-1980's. Most openings for new workers will develop as experienced dispatchers and their assistants retire, die, or transfer to other occupations.

The need for some additional dispatchers will result from the increase in air traffic, the addition and extension of routes, and the extra difficulties in launching jet aircraft. However, these factors will be largely offset by improved communication facilities and related computer technology which allow dispatchers at major terminals to dispatch aircraft at other airports and over large geographic areas.

Earnings and Working Conditions

Beginning dispatchers earned between $1,000 to $1,200 a month in 1972. As a rule, dispatchers and their immediate families are entitled to a limited amount of free transportation or reduced fares on their companies' flights. In addition, they may fly at greatly reduced rates with other airlines. Dispatchers usually receive from 2 to 4 weeks of vacation with pay, depending on length of service. They also receive paid sick leave, life and health insurance, and retirement benefits.

Most dispatchers are represented by the Transport Workers Union of America and the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

Information about job opportunities in a particular airline and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of companies are available from:

Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

FLIGHT ATTENDANTS

(D.O.T. 352.878)

Nature of the Work and Places of Employment

Flight attendants (also called stewardesses and stewards) are aboard almost all commercial passenger planes to help make the passengers' flights safe, comfortable, and enjoyable. Like other members of the flight crew, they are responsible to the captain.

Before each flight, attendants find out how many passengers to expect and how long the trip will take. They then see that the passenger cabin is in order, that supplies and emergency equipment are aboard, and that food and beverages are in the galley. As passengers come aboard, flight attendants greet them, check their tickets, and assist them with their coats and small luggage.

In addition, flight attendants use the public address system to instruct passengers in the use of emergency equipment and check to see that all passengers have their seat belts fastened. In the air, they answer questions about the flight and weather, distribute reading matter and pillows, and help care for small children. On many flights, they serve cocktails and precooked meals.

Places of Employment

About 39,000 flight attendants worked for the airlines in 1972. The vast majority were women, though men now receive equal consideration for available jobs. Most flight attendants are stationed in major cities at the airlines' main bases. A few who serve in international flights are based in foreign countries.

Airlines generally carry 1 to 10

flight attendants, depending on the size of the plane and the proportion of economy to first-class passengers. Large aircraft like the Boeing 747 may have as many as 16 flight attendants.

Training, Other Qualifications, and Advancement

The airlines place great stress on the hiring of poised, tactful, and resourceful young people. As a rule, applicants must be 19 years old and from 5 feet 2 inches to 6 feet tall, with weight in proportion to height. They must be in excellent health. They also must speak clearly and have good vision.

Applicants must be high school graduates. Those having 2 years of college, nurses' training, or experience in dealing with the public are preferred. Flight attendants who work for international airlines generally must be able to speak an appropriate foreign language fluently.

Most large airlines give newly hired flight attendants about 5 weeks' training in their own schools. Transportation to the training centers and an allowance while in training may be provided. Training includes classes in flight regulations and duties, company operations and policies, emergency procedures and first aid, and personal grooming. Additional courses in passport and customs regulations are given trainees for the international routes. Towards the end of their training students go on practice flights.

The few airlines that do not operate schools generally send new employees to the school of another airline. Before enrolling in a private school, young people should check with the airline of their choice to make sure the school's training is acceptable.

After completing their training, flight attendants report for work at one of their airline's main bases. New flight attendants usually fill in on extra flights or replace flight attendants who are sick or on vacation. Because assignments are based on seniority, experienced flight attendants usually get their choice of flights.

Opportunities for advancement are limited; however, some flight attendants may advance to customer service director, instructor, or recruiting representative.

Employment Outlook

Employment is expected to grow very rapidly through the mid-1980's as a result of the need to provide services for more airline passengers. For passenger safety, the Federal Aviation Administration requires one flight attendant for every 50 seats on an airliner. More attendants will be needed as airlines increase the number and size of aircraft in operation. In addition, many openings will occur because of the need to replace experienced flight attendants who retire, die, or transfer to other occupations. Continued fuel shortages, however, may adversely affect employment growth.

Earnings and Working Conditions

An examination of union contracts covering several large domestic and international airlines indicates that earnings of beginning flight attendants ranged from $600 to $665 in 1972. Experienced flight attendants earned $875 to $925 a month.

Since airlines operate around the clock, 365 days a year, flight attendants may work at night, on holidays, and on weekends. They usually fly no more than 80 hours a month but they may devote up to 35 hours a month to ground duties. As a result of variations in scheduling and limitations on flying time, some flight attendants may have 15 days or more off each month. Of course, some time off may occur between flights while away from home. Flight attendants may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide living accommodations and an allowance for expenses.

As a rule, flight attendants and their immediate families are entitled to a limited amount of free or reduced-fare transportation on their airline. In addition, they may fly at greatly reduced rates on other airlines. Flight attendants usually receive 2 to 4 weeks' vacation with pay. They also receive paid sick leave, life and health insurance, and retirement benefits.

Flight attendants have the opportunity to meet interesting people and see new places. However, the work can be strenuous and trying. Flight attendants may stand during much of the flight. They must remain pleasant and efficient regardless of how tired they may be.

Most flight attendants are members of either the Air Line Stewards and Stewardesses Association of the Transport Workers Union of America or the Stewards and Stewardesses Division of the Air Line Pilots Association, International.

Sources of Additional Information

Information about job opportunities in a particular airline and the qualifications required may be obtained by writing to the personnel manager of the company. Address of companies are available from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

FLIGHT ENGINEERS

(D.O.T. 621.281)

Nature of the Work

Flight engineers are members of flight crews who make sure the mechanical and electrical devices aboard airplanes work properly. After attending a general briefing with the pilot and copilot to obtain weather information and other details about the flight, they check maintenance records and may check the tires and other outside parts of the plane. If any faulty equipment is located, a mechanic is called to make repairs.

From their station in the cockpit, flight engineers assist the pilot and copilot in making preflight checks of instruments and equipment. They make sure each fuel tank has been filled, adjust the electrical power, and check the engine instruments. After take off, flight engineers watch instruments and operate controls to regulate the performance of the engines, air conditioning, and other equipment. They also keep records of engine performance and fuel consumption. They report any mechanical problems to the pilot, and if possible, make emergency repairs in flight. At the few airports where there are no mechanics, flight engineers may make minor repairs, and those employed by smaller airlines may assist in refueling.

Places of Employment

About 7,000 flight engineers were employed in 1972. The Federal Aviation Administration requires flight engineers to be on most three- and four-engine aircraft and some two-engine jet aircraft. As a result, most engineers work for airlines and are stationed in major cities at the airlines' main bases.

Training, Other Qualifications, and Advancement

Most scheduled airlines now require applicants for flight engineers positions to have a commercial pilot's license. This license requires skill, training and experience as a pilot. (See the statement on pilots and copilots elsewhere in the *Handbook*.)

Before applicants can fly as crew members, they also must have a flight engineer's license from the Federal Aviation Administration. They can qualify for a flight engineer's license if they have had 3 years of experience in repairing or overhauling aircraft and engines or experience as a pilot or flight engineer in the Armed Forces. In addition, applicants must pass a rigid physical examination and a written test on flight theory and engine operation. They also must pass a flight check of operating procedures for the type of plane they will be assigned. Completing a private course of ground and flight instruction which is approved by the Federal Aviation Administration is the most common method of qualifying for a license.

Airlines generally prefer applicants who are 21 or 35 years of age, from 5 feet 6 inches to 6 feet 4 inches tall, and in excellent physical condition. They must be able to cope with the pressures and responsibilities that are part of the occupation, and must be able to work as

part of a team. Good eyesight, including normal color vision, is essential. All airlines require a high school education, and they prefer at least 2 years of college.

Although airlines favor applicants who already have a flight engineer's license and a commercial pilot's license, they may train those who have only the pilot's license.

Advancement opportunities usually depend on qualifications and seniority provisions established by union contracts. The flight engineer who has pilot qualifications, generally called the second officer, advances on the basis of seniority to copilot, and then follows the regular line of advancement open to other copilots. Flight engineers who do not have pilot qualifications can select more desirable routes and schedules as they gain seniority.

Employment Outlook

Employment is expected to increase rapidly through the mid-1980's. In addition, several hundred openings will occur each year as experienced flight engineers transfer to jobs as copilots, retire, or die. Assuming no significant continued fuel shortages, growth in airline traffic will create a need for more airplanes and more engineers.

Earnings and Working Conditions

Monthly earnings of beginning flight engineers ranged from $650 to $690 in 1972, according to information from several union contracts. Monthly earnings of experienced flight engineers ranged from $2,000 to $3,000. Earnings depend on size, speed, and type of plane; hours and miles flown; length of service; and the type of flight (such as night or international).

As a rule, flight engineers and their immediate families are entitled to a limited amount of free or reduced fare transportation on their company's flights. In addition, they may travel on other airlines at greatly reduced rates. Engineers may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide living accommodations and an allowance for expenses. Airlines operate flights at all hours of the day and night, so engineers often have irregular work schedules.

Flight engineers usually receive 2 to 4 weeks of vacation with pay. They also receive paid sick leave, life and health insurance, and retirement benefits.

Flight engineers who are qualified pilots (Second Officers) are represented by the Air Line Pilots Association, International. Most others belong to the Flight Engineers' International Association or to the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Sources of Additional Information

Career information and a list of schools offering flight engineer training are available from:

Flight Engineers' International Association, 905 16th St. NW., Washington, D.C. 20006.

Information about job opportunities in a particular airline and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of airline companies and details on physical and educational qualifications for flight engineers may be obtained from:

Air Line Pilots Association, International, 1625 Massachusetts Ave. NW., Washington, D.C. 20036.

GROUND RADIO OPERATORS AND TELETYPISTS

(D.O.T. 193.282 and 203.588)

Nature of the Work

Ground radio operators and teletypists transmit weather and flight information between ground station personnel and flight personnel. Radio operators use a radio-telephone to send and receive messages. Operators may occasionally make minor repairs on their equipment. Teletypists transmit written messages only between ground personnel. They operate a teletype machine which has a keyboard similar to that of a typewriter.

Flight service station specialists employed by the Federal Aviation Administration (FAA) have jobs similar to those of radio operators and teletypists. They give pilots weather and navigational information during flights, and relay messages from air-traffic control facilities.

Places of Employment

About 5,700 ground radio operators and teletypists were employed in air transportation in 1972. Flight service station specialists employed by the FAA made up about two-thirds of this total, and airlines employed most of the remainder.

The FAA's specialists work at stations scattered along the major airline routes; some stations are in remote places. Ground radio operators and teletypists for airlines work mostly at airports in or near large cities.

Training, Other Qualifications, and Advancement

Applicants for airline radio operator jobs usually must have at least a third-class Federal Communications Commission (FCC) radio-

telephone or radio-telegraph operator's permit. However, a second-class operator's permit is preferred. They also must be high school graduates and have a good speaking voice, and a basic knowledge of the language used in weather reports. Teletypists must have training or experience in operating teletype equipment and must be able to type at least 40 words a minute.

To qualify for entry positions as FAA flight service station specialists, applicants must pass a written test and meet certain experience requirements. Permanent appointments are made on the basis of Federal civil service examinations.

Radio operators, teletypists, and FAA flight service station specialists serve probationary periods during which time they receive on-the-job training. Skill gained in communications is helpful experience for transferring into higher paying jobs such as airline dispatcher.

Employment Outlook

Employment in these occupations is expected to decrease slowly through the mid-1980's. Employment will be limited by automatic centralized communication systems and improvements in two-way radios that permit direct communication between pilots and air-traffic controllers. However, each year a few openings will result from the need to replace experienced workers who transfer to other occupations, retire or die.

Earnings and Working Conditions

The beginning salary for airline radio operators ranged from $775 to $1,000 a month in 1972. The beginning salary for teletypists was $540 a month and ranged up to $815 after 5 years. Beginning FAA flight service station specialists earned from $640 to $790 a month, and experienced specialists earned from $1,170 to $1,390.

As a rule, airline radio operators and teletypists and their immediate families are entitled to a limited amount of free or reduced fare transportation on their companies' flights. In addition, they may fly at greatly reduced rates with other airlines. Radio operators and teletypists usually receive 2 to 4 weeks of vacation with pay, depending on length of service. They also receive paid sick leave, life and health insurance, and retirement benefits. Flight service specialists for the Federal government receive 13 to 26 days of paid vacation and 13 days of sick leave a year, as well as retirement, life insurance, and health benefits.

Radio operators and teletypists in a number of airlines are unionized. The major union for these occupations is the Communications Workers of America.

Sources of Additional Information

Information about job opportunities in a particular airline and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of companies are available from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

Inquiries about job opportunities with the FAA should be addressed to the Personnel Officer at FAA regional offices. Addresses of the regional offices are available from:

Personnel Operations Division Federal Aviation Administration, 800 Independence Ave. SW., Washington, D.C. 20591.

PILOTS AND COPILOTS

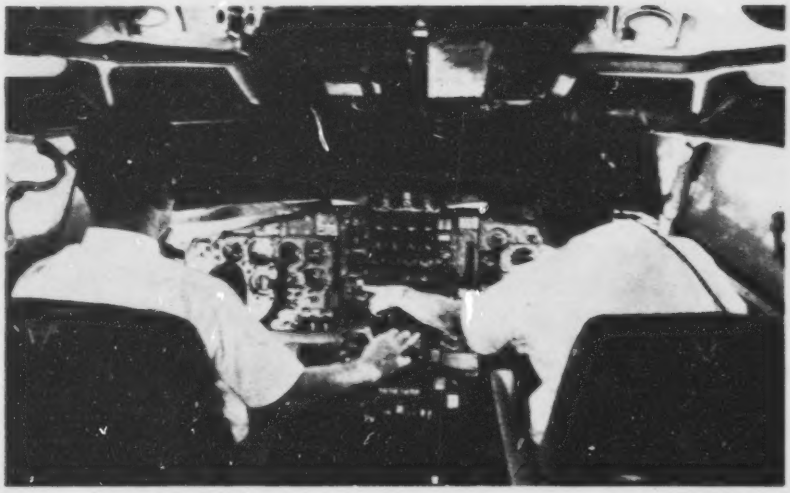
(D.O.T. 196.168, .228, .268, and .283)

Nature of the Work

Pilots and copilots are skilled, highly trained professionals who have been carefully selected for their ability to fly safely. They transport passengers and cargo and perform other tasks such as crop dusting and inspecting power lines. The pilot (called captain by the airlines) is in charge of the plane, and supervises all other crew members. The copilot assists the captain in air-to-ground communications, monitoring flight and engine instruments, and in operating the plane's controls.

Both captain and copilot must do great deal of planning before taking off. They confer with the company weatherman and, in cooperation with the airline dispatcher, choose a route, speed, and altitude that will give a safe, smooth flight. The captain then coordinates the route with air traffic control personnel.

Before takeoff, the captain and copilot "preflight" the airplane, checking the engines, controls, instruments, and other components to make sure everything is working properly. During the flight, they radio to ground control stations to report their plane's altitude, air speed, weather conditions, and other flight details. The captain steers the plane to each point on the flight plan and changes altitude and speed as necessary. The captain and the copilot watch instruments that indicate the amount of fuel and condition of the engines, and provide navigation information. If visibility is poor during the landing approach, they may rely on instruments such as the altimeter, and air speed and course indicators. After parking the plane, they go to the airline office and complete flight records required by the company.



Some specially trained airline pilots are evaluators. They fly with each pilot at least twice a year to make sure Federal Aviation Administration (FAA) and company regulations are obeyed. Another group teaches pilots and copilots to fly new airplanes.

Although pilots employed by businesses usually fly smaller planes than airline pilots, their preflight and flight duties are much alike. These pilots, however, usually are not assisted by flight crews, and may perform minor maintenance and repair work on their planes.

Places of Employment

About 54,000 civilian pilots and copilots worked full-time in 1972. About 50 percent worked for large airline companies and most were stationed near large cities where major airports are located. Most of the remainder trained student pilots or worked for large corporations that use their own airplanes to transport company executives. Others performed a variety of services for many different employers throughout the country. Some flew air taxis or crop dusting planes. A small number inspected pipelines or provided sightseeing trips. Federal, State, and local governments also employed pilots and copilots.

Training, Other Qualifications, and Advancement

Commercial pilots and copilots must be licensed by the Federal Aviation Administration (FAA). All must have a commercial airplane pilot's license, and airline captains also must have an airline transport pilot's license. All pilots and copilots also must have a rating for the class of plane they can fly (single-engine, multi-engine, or seaplane), and for the specific type of planes, such as DC-9 or Boeing 747. In addition, airline pilots and copilots and others who fly in bad weather must have an instrument rating.

To qualify for the commercial pilot's license, applicants must be at least 18 years old and have at least 200 hours of flight experience. For an instrument rating, applicants must practice instrument flying for at least 40 hours. Applicants for an airline transport pilot's license must be at least 23 years old and have a minimum of 1,500 hours of flight time during the previous 8 years, including night and instrument flying.

Before pilots may receive any license they must pass a strict physical examination and a written test covering subjects such as principles of safe flight, navigation techniques, and FAA regulations. They also must submit proof that they have completed the minimum flight time requirements and, in a practical test, demonstrate their ability to fly a plane. The license remains in effect as long as the pilot can pass an annual physical examination and the periodic tests of flying skills required by Government regulation. However, pilots may not fly an airliner after age 60.

A young person may learn to fly in the military or in civilian flying schools. Either kind of training satisfies the flight experience requirements for licensing. Graduates of private schools must pass a FAA flight check in a plane of their choice and a written examination on FAA regulations. Applicants who have appropriate military training and experience are required only to pass a written examination and physical examination if they apply for a license within a year after leaving the service. Those trained in the armed services have had the added opportunity to gain experience on large aircraft similar to airliners.

As a rule, applicants for a copilot job with the airlines must be between 20 and 35 years old. They must be 5 feet 6 inches to 6 feet 4 inches tall and weigh between 140 and 210 pounds. All applicants must be high school graduates; most airlines require 2 years of college and prefer to hire college graduates. Physical requirements for pilots, especially in scheduled airlines, are very high. They must have corrected vision of 20/20, good hearing, and no physical handicaps that prevent quick reactions. The airlines use psychological tests to determine an applicant's ability to make quick decisions and accurate

judgements under pressure.

Applicants hired by the scheduled airline companies usually start as flight engineers, although they may begin as copilots. An applicant for a job with an airline often must have more than the FAA minimum qualifications for a commercial pilot's license. For example, airlines generally require 500 to 1,000 hours of flight experience, whereas only 200 hours are needed for the commercial license.

All newly hired airline copilots go through company orientation courses. Trainees receive classroom instruction on subjects such as flight theory, and weather as well as FAA and company regulations. In addition, some airlines give beginning copilots or flight engineers from 3 to 10 weeks of flight training in classrooms and simulators and on company planes before assigning them to a scheduled flight.

Beginning copilots generally have limited responsibilities, such as operating the flight controls in good weather over a route that is easy to navigate. As they gain experience and skill, they handle pregressively more complex assignments. Copilots who have enough skill and experience and have passed the test for an airline transport pilot's license, can advance to captain. A minimum of 2 or 3 years' service is required for promotion but, in actual practice, advancement to captain takes 5 to 10 years or longer.

Employment Outlook

A very rapid rise in the employment of pilots and copilots is expected through the mid-1980's. In addition to jobs that result from employment growth, several thousand openings will arise as experienced pilots and copilots retire, die, or change occupations.

Assuming no significant continued fuel shortage, growth in airline traffic will create a need for more airplanes and more pilots and copilots to fly them. Employment in business flying also is expected to increase as the Nation's economy expands.

Earnings and Working Conditions

Pilots and copilots are among the highest wage earners in the Nation. In 1970, those who worked full time averaged $17,206 a year, more than double the average for male workers as a whole. Pilots and copilots for airlines earn more than those employed by business and government. In 1972, a union contract with a major airline indicated that copilots earned from $17,500 to $40,000 a year, and pilots from $37,000 to $60,000.

Earnings depend on factors such as the type, size, and speed of the planes, and the number of hours and miles flown. Airline-captains and copilots who have at least 1 year of service are guaranteed minimum monthly earnings which are about four-fifths as much as the maximum they could possibly earn. Extra pay is given for night and international flights.

As a rule, airline pilots and their immediate families are entitled to a limited amount of free or reduced fare transportation on their companies' flights. In addition, they may travel at greatly reduced rates with other airlines. Airline pilots may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide living accommodations and an allowance for expenses.

Airlines operate flights at all hours of the day and night so work schedules are often irregular. Under the Federal Aviation Act, airline pilots and copilots cannot fly more than 85 hours a month. Most actually fly only about 60 hours a month, but their total duty hours, including layovers before return flights, usually exceed 100 hours a month.

Pilots and copilots employed by airlines usually receive 2 to 4 weeks of vacation with pay, depending on their length of service. They also receive paid sick leave, life and health insurance, and retirement benefits. Those who work for the Federal Government receive 13 to 26 days of paid vacation and 13 days of paid sick leave a year, as well as life and health insurance, and retirement benefits.

Although flying does not involve much physical effort, the pilot often is subject to stress and must be constantly alert and prepared to make decisions quickly.

Most airline pilots are members of the Air Line Pilots Association, International. Those employed by one major airline are members of the Allied Pilots Association.

Sources of Additional Information

Information about job opportunities in a particular airline and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of companies and details about physical and educational requirements for pilots may be obtained from:

Air Line Pilots Association, 1625 Massachusetts Ave. NW., Washington, D.C. 20036.

Inquiries about jobs with the Federal Aviation Administration should be addressed to the personnel department at the nearest FAA regional office. Addresses of the regional offices are available from:

Personnel Operations Division, Federal Aviation Administration, 800 Independence Ave. SW., Washington, D.C. 20591.

TRAFFIC AGENTS AND CLERKS

(D.O.T. 912.368, 919.368)

Nature of the Work

Traffic agents and clerks include ticket or reservation agents and clerks, operations or station agents, and traffic representatives. They sell flight tickets, reserve seats and cargo space, and supervise the loading of planes.

Reservation agents and clerks give customers information on flight schedules and fares over the telephone. After making a reservation, they report it to a central computer or to clerks in other cities so that the same space will not be sold twice. On the larger airlines, computers are used to keep track of flight space information so that personnel at all reservation offices know immediately if a plane has seats available.

Ticket agents sell tickets and fill out ticket forms with information such as the flight number and the passenger's name and destination. They also check and weigh baggage, answer questions about schedules and fares, and keep records of tickets sold.

Operations or station agents supervise the loading and unloading of the aircraft and sometimes do this work themselves. They see that the weight carried by the planes is distributed properly, prepare a list of cargo, and keep records of the number of passengers carried. They also may make arrival and departure announcements. Traffic representatives contact business customers to promote greater use of their airline's freight and passenger service.

Places of Employment

About 60,000 traffic agents and clerks were employed in 1972. Most worked in downtown ticket and reservation offices and at airports in or near large cities, where most airline passenger and cargo business originates. Some are employed in smaller communities served by airlines.

Training, Other Qualifications, and Advancement

Because traffic agents and clerks must deal directly with the public, airlines have strict hiring standards with respect to appearance, personality, and education. A good speaking voice is essential, because these employees frequently use the telephone or public address systems. High school graduation generally is required, and some college training is preferred.

Traffic agents may advance to traffic representative and supervisor. A few eventually become city and district managers. College courses in transportation, such as traffic management, improve the chances for advancement.

Employment Outlook

Employment of traffic agents and clerks is expected to increase very rapidly through the mid-1980's. In addition to the jobs that result from employment growth, many openings will arise as experienced workers retire, die, or transfer to other jobs.

Assuming no significant continued fuel shortages, more traffic agents and clerks will be needed because of the increase in passengers and cargo traffic. Although airlines are installing machines to process reservations, keep records, and perform other routine tasks, machines cannot replace the personal contact that is an important part of a traffic agent's or clerk's job.

Earnings and Working Conditions

Beginning salaries for reservation and ticket agents ranged from $600 to $690 a month in 1972, based on information from union contracts covering several airlines. Beginning salaries for station and operations agents ranged from $625 to $700 a month.

Traffic agents and clerks and their immediate families are entitled to a limited amount of free or reduced fare transportation on their company's flights. In addition, they may fly on other airlines at greatly reduced rates. Traffic agents and clerks usually receive 2 to 4 weeks of vacation with pay. They also receive paid sick leave, health and life insurance, and retirement benefits.

Many reservation and transportation agents belong to labor unions. Four unions cover most of the organized agents: the Air Line Employees Association International; the Transport Workers Union of America; the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.)

Sources of Additional Information

Pamphlets describing the duties of traffic agents and clerks are available from:

Air Line Employees Association 5600 S. Central Ave., Chicago, Ill. 60638.

Information about jobs in a particular airline may be obtained by writing to the personnel manager of the company. Addresses of companies are available from:

Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

MERCHANT MARINE OCCUPATIONS

The American merchant marine is a vital link in the Nation's transportation system. It transports America's exports and, in turn, brings imports from the rest of the world. In time of military conflict, it carries troops, arms, and supplies to combat areas. Seafaring employment offers a variety of interesting and rewarding careers as well as travel and adventure.

About 32,000 officers and seamen worked aboard U.S. oceangoing vessels in late 1972. The work aboard ships is divided among the deck, engine, and steward departments. The deck department is responsible for navigation, maintenance of the hull and deck equipment, and the supervision of loading, unloading, and storing of cargo. Personnel in the engine department operate and maintain the machinery that propels the vessel. The steward's department feeds the crew and maintains living and recreation areas.

Although employment in merchant marine occupations is expected to decline moderately through the mid-1980's, some job openings will arise from the need to replace experienced workers who retire, die, or quit the sea for other reasons. Competition for these openings, however, will be severe because the number of people seeking merchant marine jobs is expected to be much greater than the number of openings.

Due to higher labor and shipbuilding costs the U.S. merchant fleet finds it difficult to compete in the world shipping market. To insure that our country has a fleet operating in regular or essential trade routes, the Government subsidizes many ships and in 1970 passed a law to subsidize the construction of 30 new ships annually over a 10 year period. The number of ships built, however, is expected to be about the same as the number of older ones taken out of service. Therefore, the size of the U.S. merchant fleet probably will not grow, and because newer ships are larger and faster and can be operated with smaller crews, fewer officers and seamen will be needed.

MERCHANT MARINE OFFICERS

Nature of the Work

In command of every ocean going vessel is the *captain* (D.O.T. 197.168) or *master* who is the shipowner's sole representative. He has complete authority and responsibility for ship operation, including discipline and order, and the safety of the crew, passengers, cargo, and vessel.

While in port, the captain may serve as the shipowner's agent in conferring with custom officials, and in some cases, act as paymaster for the ship. Although not technically a member of a specific department, he generally is associated with the deck department, from whose ranks he has been promoted.

Deck Department. Deck officers or "mates" as they are traditionally called direct the navigation of the ship and the maintenance of the deck and hull. They maintain the authorized speed and course; plot the vessel's position at frequent intervals; post lookouts when required; record information in the "log" of the voyage; and immediately notify the captain of any unusual occurences. Deck officers must be familiar with modern navigational devices, such as sonar and radio directional finders, to operate ships safely and efficiently.

The *chief mate* (D.O.T. 197.133), also known as the first mate or chief officer, is the captain's key assistant in assigning duties to the deck crew and maintaining order and discipline. He also plans and supervises the loading and unloading of cargo, and assists the captain in taking the ship in and out of port. On some ships the chief mate also may be in charge of first aid treatment.

By tradition, the *second mate* (D.O.T. 197.133) is the navigation officer. He sees that the ship is provided with the necessary navigation charts and that navigating equipment is maintained properly.

The *third mate* (D.O.T. 197.133), the most junior-rated deck officer, is responsible for the care and the maintenance of the navigating bridge and the chartroom. He acts as the signal officer and is in charge of all signaling equipment. He also assists in the supervision of cargo loading and unloading. The third mate frequently inspects lifesaving equipment to be sure it is ready for use in fire, shipwreck, or other emergencies.

Engine Department. Marine engineers operate and maintain all engines and machinery aboard ship. The *chief engineer* (D.O.T. 197.130) supervises the engine department, and is responsible for the efficient operation of engines and other mechanical equipment. He oversees the operation of the main power plant and auxiliary equipment while the vessel is underway and keeps record of equipment performance and fuel consumption.

The *first assistant engineer*

Chief mate directs speed and course of cargo ship.

(D.O.T. 197.130) supervises engine room personnel and directs operations such as starting, stopping, and controlling the speed of the main engines. He oversees and inspects the lubrication of engines, pumps, generators, and other machinery, and with the aid of the chief engineer, directs all types of repairs.

The *second assistant engineer* (D.O.T. 197.130) has charge of the boiler and associated equipment such as the water-feed system and pumps. He makes sure proper steam pressure and oil and water temperatures are maintained. He also supervises the cleaning of boilers.

The *third assistant engineer* (D.O.T. 197.130) supervises the operation and maintenance of the lubrication system and a variety of other engineroom equipment. Some third assistant engineers are responsible for the electrical and refrigeration systems aboard ships.

Other officers. A ship keeps contact with the shore and other vessels through its *radio officer* (D.O.T. 193.282), who also maintains radio equipment. A passenger ship carries three to six radio officers; the average cargo vessel employs one. The officer sends and receives messages by voice or Morse code. He periodically receives and records time signals, weather reports, position reports, and other information. The radio officer also may maintain depth recording equipment and electronic navigation equipment.

Some freighters and all passenger vessels carry *pursers* (D.O.T. 197.168). The purser or staff officer does the extensive paperwork required to enter and clear a ship in each port, prepares payrolls, and assists passengers as required. In recent years, the Staff Officers Association has established a program to train pursers to act also as pharmacists' mates. This instruction is designed to improve the medical care aboard freighters and tankers and facilitate Public Health clearance when a ship arrives in port. All passenger ships must carry licensed doctors and nurses.

Places of Employment

Nearly 8,500 officers were employed aboard U.S. oceangoing vessels in late 1972. Deck officers and engineering officers accounted for more than four-fifths of the total, and radio officers made up most of the remainder.

About 65 percent of the officers were aboard freighters and 32 percent were aboard tankers. The remaining 3 percent manned passenger vessels.

Training, Other Qualifications, and Advancement

People applying for an officer's license in the deck and engineering departments of oceangoing vessels must meet certain legal requirements. Captains, chief and second mates, and chief and first assistant engineers must be at least 21 years old. The minimum age for third mates, third assistant engineers, and radio operators is 19. In addition, applicants must present proof

of U.S. citizenship and obtain a U.S. Public Health Service certificate attesting to their vision, color perception, and general physical condition.

In addition to legal and medical requirements, candidates must also have at least 3 years of appropriate sea experience or be a graduate of an approved training program. Deck officer candidates must pass Coast Guard examinations that require extensive knowledge of seamanship, navigation, cargo handling, and deck department operations. Marine engineering officer candidates must demonstrate in-depth knowledge of propulsion systems, electricity, plumbing and steam fitting, metal shaping and assembly, and ship structure. To advance to higher ratings, officers must pass progressively more difficult examinations.

For a Coast Guard license as a radio officer, applicants must have a first or second-class radiotelegraph operator's license issued by the Federal Communications Commission. For a license to serve as the sole radio operator aboard a cargo vessel, the Coast Guard also requires 6 months of radio experience at sea.

Unlike most professions, no education requirements have been established for officers. A seaman with 3 year's experience in the deck or engine department may apply for either a third mate's license or for a third assistant engineer's license. However, because of the complex machinery, navigational, and electronic equipment on modern ships, formal training usually is needed to pass the Coast Guard's examination for these licenses.

The fastest and surest way to become a well-trained officer is through an established training program. Such programs are available at the U.S. Merchant Marine Academy at Kings Point, N.Y. and at five State merchant marine academies: California Maritime Academy, Vallejo, Calif.; Maine Maritime Academy, Castine, Maine; Massachusetts Maritime Academy, Hyannis, Mass.; Texas Maritime Academy, Galveston, Tex.; and New York Maritime College, Fort Schuyler, New York, N.Y. About 550 students graduate each year from these schools; about one-half are trained as deck officers and one-half as marine engineers. Entrance requirements are very high. Admission to the Federal academy is through nomination by a member of Congress, whereas entrance to the other academies is made through written application directly to the school.

Most of the academies offer 3- or 4-year courses in nautical science or marine engineering, as well as practical experience at sea. Subjects include navigation, mathematics, electronics, seamanship, propulsion systems, electrical engineering, languages, history, and shipping management. After Coast Guard examinations are passed, licenses are issued for either third mate or third assistant engineer. In addition, graduates may receive commissions as ensigns in the U.S. Naval Reserve.

Because of their thorough grounding in theory and its practical application, academy graduates are in the best position to move up to master and chief engineer ratings. Their well-rounded education also helps qualify them for shoreside jobs such as marine superintendent, operating manager, or shipping executive.

A number of trade unions in the maritime industry provide officer training. These unions include the International Organization of Masters, Mates and Pilots; the Seafarers' International Union; the Brotherhood of Marine Officers; and the National Marine Engineers' Beneficial Association. Most union programs are designed to upgrade experienced seamen to officer ratings, although some programs accept inexperienced young men. For example, the National Marine Engineers' Beneficial Association (MEBA) operates the Calhoon MEBA Engineering School in Baltimore, Md., which offers high school graduates a 3-year apprenticeship training program in preparation for a third assistant engineer's license. The program consists of both classroom instruction and sea experience and provides free room, board, medical care, and text books in addition to a monthly grant. Trainees must agree to serve at least 3 years in the U.S. Merchant Marine after the 3-year training period.

The U.S. Merchant Marine Academy now selects 10 percent of the approximately 300 men who enter the academy each year to be trained as "omnicompetent" officers. They are taught both navigational and technical skills so they can work in either the deck or engine department.

Advancement for deck and engine officers is along well-defined lines and depends primarily upon specified sea experience, passing a Coast Guard examination, and leadership ability. Deck officers start as third mates. After 1 year's service they are eligible to take a second mate examination. A second mate may apply for a chief mate's license after 1 year of service, and a chief mate may apply for a captain's license after 1 year of service. An officer in the engine department starts as third assistant engineer. After 1 year of service, he may apply for a second assistant's license and finally a chief engineer's license.

Employment Outlook

Employment of ship's officers is expected to decline moderately

through the mid-1980's. Some job openings will arise each year, however, due to the need to replace experienced officers who retire, die, or take shoreside employment.

The number of ships in our merchant fleet is not expected to increase in the years ahead (See introduction on merchant marine occupations). Older vessels will be replaced by larger, mechanized ships equipped with the latest labor-saving innovations. A central console in the newest ships, for example, controls engines, boilers, and related propulsion equipment, so the need for officers in charge of such equipment is reduced.

Earnings and Working Conditions

Earnings of officers depend upon their rank and the type of ship. Wages are highest on large ships. The accompanying tabulation shows monthly base wages for officers aboard an average freighter in 1972. Additional payments for overtime and assuming extra responsibilities generally average about 50 percent of base pay. For example, a second mate with a monthly base pay of $955 may regularly earn about $1,433 each month.

	Base pay 1
Captain	$2,443
First mate	1,347
Second mate	955
Third mate	858
Radio officer	1,056
Purser	772
Chief engineer	2,253
First assistant engineer	1,347
Second assistant engineer	955
Third assistant engineer	858

[1] East Coast wages in June 1972 aboard a 12,000-17,000 power ton single screw ship.

Officers and their dependents enjoy substantial pension and welfare benefits. Vacations range from 90 to 180 days a year. Officers with 20 years of service have the option of a monthly pension of $325 or 37½ percent of their monthly rate of pay. Those who have 25 years of service are eligible for $425 a month or 50 percent of their monthly rate. Officers forced to retire prematurely due to a permanent disability receive partial pensions. Comprehensive medical care and hospitalization are provided for officers and their families through union programs.

The workweek aboard ship is considerably different from the workweek on shore. At sea, most officers are required to stand watch. Watchstanders work 7 days a week. Generally, they work two 4-hour watches (shifts) during every 24-hour period and have 8 hours off between each watch. Some officers are day workers. They work 8 hours a day, Monday through Friday. Both watchstanders and day workers are paid overtime for work over 40 hours a week. When the ship is in port, the basic workweek is 40 hours for all crew members.

The duties aboard ship are hazardous compared to other industries. At sea, there is always the possibility of injuries from falls or the danger of fire, collision, or sinking.

A number of labor organizations represent merchant marine officers. The two largest are the International Organization of Masters, Mates and Pilots representing deck officers and the National Marine Engineers' Beneficial Association representing engineering officers. The Brotherhood of Marine Officers represents deck and engine officers on some ships. The Staff Officers Association represents pursers aboard certain freighters. Radio officers are represented by the American Radio Association and the Radio Officers Union. In addition, a number of independent unions organize officers on tankers. Officer's unions may require initiation fees as high as $1,000.

Sources of Additional Information

General information about merchant marine officer's jobs may be obtained from:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings, qualifications for employment, wage scales and other particulars can be obtained from local maritime officers' unions. If no maritime union is listed in the local telephone directory, information may be obtained from:

International Organization of Masters, Mates and Pilots, 39 Broadway, New York, N.Y. 10006.

National Marine Engineers' Beneficial Association, 17 Battery Place, New York, N.Y. 10004.

MERCHANT SEAMEN

Seamen make up most of a ship's crew and do most of the manual labor. Employment is along craft lines with varying skill levels. Each worker is assigned to one of the following departments: deck, engine, and steward's.

DECK DEPARTMENT. Ordinary Seamen (D.O.T. 911.887), the entry rating in the deck department, scrub decks, coil and splice ropes, paint, clean personnel quarters, and do other general maintenance work. Ordinary seamen also may relieve able seamen who steer the ship and act as lookouts. All freighters and tankers customarily employ three ordinary seamen.

Able Seamen (D.O.T. 911.884) represent about one-fifth of all seamen. They must have a thorough knowledge of all parts of the ship and be able to handle all gear and deck equipment. They act as helms-

men or quartermasters to steer the ship. Usually, they each take 2-hour turns at the wheel, and as lookouts report sightings to deck officers. Freighters and tankers usually have six able seamen.

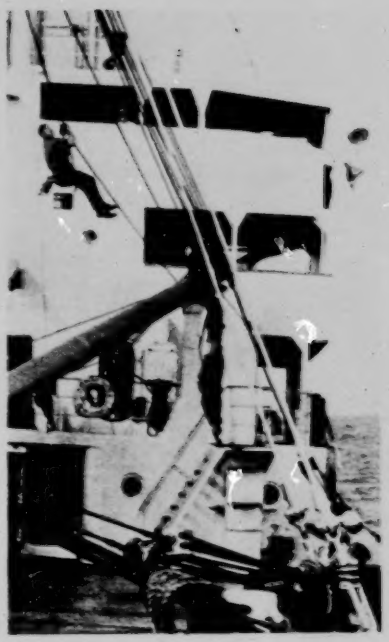
Able seamen also are responsible for rigging, repairing, and stowing cargo-handling and other gear. They must be able to tie common knots and handle mooring lines when the ship is docking or departing. In addition to their more skilled tasks, they do general deck maintenance work similar to that done by ordinary seamen.

Because of the ever-present danger of fire at sea, able seamen must be familiar with fire prevention and control methods. They participate in periodic boat drills and are trained in all operations connected with launching lifeboats and life rafts.

The *boatswain* (D.O.T. 911.131), or bosun, is the highest ranking able seaman. As foreman in charge of the deck crew he relays the deck officers' orders and sees that these orders are carried out. The boatswain assists the chief mate in assigning work to crew members and directs general maintenance operations such as cleaning decks and polishing metalwork. When the ship docks or anchors, he supervises the deck crew in handling the lines used for mooring.

Most cargo vessels carry one to three *deck utilitymen* (D.O.T. 911.884), who maintain the deck department under the supervision of the boatswain. They determine the condition of bilges (compartments in the bottom of the hull) and do general maintenance work.

Some vessels carry a *ship's carpenter* (D.O.T. 860.281) who secures cargo hatches and ports, and braces (shores) cargo. He may operate winches that hoist and drop the anchor and seal the hawsepipes



(steel pipes through which anchor chains pass) when anchor and chains are not in use. Because of mechanization, newer ships are sailing with fewer carpenters and deck utilitymen.

ENGINE DEPARTMENT. The engineering staff consists of a variety of occupational specialties requiring varying degrees of skill from the entry rating of wiper to specialized skilled jobs such as reefer engineer. *Wipers* (D.O.T. 699.887) keep the engine room and machinery clean. Most cargo vessels carry two or three wipers. *Oilers* (D.O.T. 911.884) lubricate mechanical equipment. They make regular rounds of ship machinery to check oil pressures and flow. Oilers also may help overhaul and repair machinery. *Firemen/watertenders* (D.O.T. 951.885) check and regulate the amount of water in the boilers, inspect gauges, and regulate fuel flow to keep steam pressure constant. They also check the operation of evaporators and condensers and test water for salt control; clean oil burning equipment; and clean strainers used to filter dirt from oil.

The *ships' electrician* (D.O.T. 825.281) repairs and maintains electrical equipment, such as generators and motors. He tests wiring for short circuits and removes and replaces fuses and defective lights. Many vessels have two electricians.

Automated ships carry *deck-engine mechanics* who replace the oilers, firemen/watertenders, and electricians on conventional vessels. Certain types of ships require workers who have special skills, such as *refrigeration engineers* (D.O.T. 950.782) who maintain proper temperatures in refrigerator compartments for perishable cargoes such as meat and vegetables.

STEWARD'S DEPARTMENT. The *chief steward* (D.O.T. 350.138) supervises the preparation and serving of meals and the upkeep of living quarters aboard ship. The *chief cook* (D.O.T. 315.131) and assistant cooks prepare meals. The chief cook also supervises the other galley (ship's kitchen) workers and is responsible for keeping the galley clean and orderly. *Utilitymen* (D.O.T. 318.887) and *messmen* (D.O.T. 350.878) complete the crew in the steward's department. These beginning jobs require little skill. Utilitymen carry food supplies from the storeroom and iceboxes, prepare vegetables, wash cooking utensils and scour galley equipment. Messmen set tables, serve meals, clean tables, wash dishes, and care for living quarters.

Places of Employment

About 23,500 seamen were employed aboard U.S. oceangoing vessels in late 1972. Nearly 64 percent were aboard freighters, and about 32 percent were aboard tankers. The remaining 4 percent manned passenger ships.

Training, Other Qualifications, and Advancement

Although not required, previous sea experience in the Coast Guard or Navy is a good background for entering the merchant marine. Applicants must have health certificates. In addition, they must obtain seaman's papers from the U.S. Coast Guard. Seaman's papers, however, do not guarantee a job. They merely qualify a person to be considered for a job when the supply of regular workers has been exhausted. To get a job, a person must be present at the hiring hall when the opening becomes available. In good shipping times, an opening may come within a week; in less prosperous times it may take much longer.

Hiring halls are located in the chief ports of the country. They are operated by unions for commercial vessels and by the Navy's Military Sealift Command (MSC) for government operated ships. In most ports along the Atlantic and Gulf Coasts and Great Lakes, the National Maritime Union or Seafarers' International Union operate hiring halls. The Sailors Union of the Pacific operates hiring halls in many ports of the West Coast. MSC employment offices are located at Brooklyn, N.Y.; New Orleans, La.; and Oakland, Calif.

The jobseeker is given a shipping card when he registers at the hiring hall. The shipping companies send job orders to the hiring hall, and the seaman who has been unemployed the longest gets first preference on any job for which he is qualified. The applicant must be present at the hall when the job is announced and he may lose his place if he is not present, or has turned down three job offers.

A seaman advances in the deck and engine departments by serving a designated period in a rating, and by successfully completing a Coast Guard examination that tests the seaman's ability to use and maintain the equipment in his department. For example, after serving a minimum of 1 year, an ordinary seaman may apply to the Coast Guard for limited endorsement as an able seaman. For full endorsement, the applicant must be 19 years of age and pass an examination to test his knowledge of seamanship and ability to carry out all the duties required of an able seaman. Seamen who have the ability to supervise may advance to boatswain after years of service.

Advancement to higher positions in the steward's department is by recommendation of the chief steward to the captain. A messman or utilityman can advance to third cook, to cook/baker, to chief cook, and finally to chief steward.

Most training programs in the industry are designed to help experienced workers upgrade their ratings. However, the Seafarers' International Union of North America operates the Harry Lundeberg School for seamanship at Piney Point, Md. that accepts and trains in general seamanship skills a limited number of young people who have no sea experience. Upgrading courses for seamen are offered by the Seafarers' Union; the National Maritime Union of America, and a number of other organizations.

Employment Outlook

Employment of seamen is expected to decline moderately through the mid-1980's. Some job openings, however, will arise each year due to the need to replace experienced seamen who retire, die, or quit the sea for other reasons.

The number of ships in our merchant fleet is not expected to increase in the years ahead (see introduction on merchant marine occupations). Older vessels will be replaced by larger ships equipped with features that reduce manpower requirements. The size of the deck crew, for example, is being reduced by technological improvements such as automatic tension mooring winches that assist in docking and undocking.

Earnings and Working Conditions

Crew members of American merchant ships enjoy excellent pay and fringe benefits. Earnings depend on job assignments and type of vessel. Basic monthly pay for a cross section of ratings on a typical freighter in 1972 is shown in the accompanying tabulation:

	Base pay [1]
Able seaman	$528
Ordinary seaman	413
Deck utilityman	590
Carpenter	639
Electrician	817
Oiler	528
Fireman/watertender	528
Wiper	491
Chief steward	694
Cook/baker	601
Messman/utilityman	410

[1] East Coast wages in June 1972 aboard a 12,000–17,000 power ton single screw ship.

Monthly wages are supplemented by premium pay for overtime and other factors. On the average, premium earnings are equal to about 50 percent base wages. For example, an oiler with a monthly base pay of $528 regularly earns about $792 each month.

Liberal employer-financed fringe benefits are provided. Vacations range from 90 to 180 days a year. Seamen may retire on pensions after 20 years of service. Seamen and their dependents are covered by comprehensive medical care and hospitalization programs.

The workweek aboard ship is considerably different from the work-

week on shore. At sea, most seamen are required to stand watch. Watchstanders work 7 days a week. Generally, they work two 4-hour watches (shifts) during every 24-hour period and have 8 hours off between each watch. Some seamen are day workers. They work 8 hours a day, Monday through Friday. Both watchstanders and day workers are paid overtime for work over 40 hours a week. When the ship is in port, the basic workweek is 40 hours for all crew members.

The duties aboard ship are hazardous compared to other industries. At sea, there is always the possibility of injuries from falls or the danger of fire, collision, or sinking.

A person working in the engine room must be able to withstand high temperatures. A deckworker must adapt to both the bitter cold and hot sun.

Accommodations for seamen aboard U.S. vessels are generally good, but not luxurious. Meals are served in a mess hall, which often doubles as a recreation room where the crew can read, write letters, play cards, and socialize. Crewmen generally share quarters aboard older ships and have little privacy, but most new ships have single rooms.

Seamen are represented by a number of labor organizations; the two largest are the National Maritime Union of America and the Seafarers' International Union of North America.

Sources of Additional Information

General information about merchant seamen jobs may be obtained from:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings, qualifications for employment, wage scales and other particulars can be obtained from local maritime unions. If no maritime union is listed in the local telephone directory, information may be obtained from:

National Maritime Union of America, 36 Seventh Avenue, New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Avenue, Brooklyn, N.Y. 11232.

RAILROAD OCCUPATIONS

People, food, and industrial materials all move along the more than 200,000 miles of railroad tracks that crisscross the Nation; and the railroads, in 1972, provided jobs for about 575,000 people. Railroad jobs are found in all States except Hawaii; the greatest number is at terminal points where the railroads maintain control offices, freight yards, and maintenance and repair shops. Chicago, the hub of the Nation's railroad system, has more railroad wokers than any other area. Large numbers of workers also are employed in New York, Los Angeles, Pittsburgh, Philadelphia, Cleveland, and St. Louis.

Although railroads vary greatly in size from the large, well known roads to small terminal and switching companies, most are organized in the same way. They usually have three major divisions in both freight and passenger operations—transportation, maintenance and repair, and administration.

In the transportation area are three groups of employees—operating workers, passenger attendants, and communications and some office workers. In 1972, about one-fourth of railroad workers were operating employees, such as locomotive engineers, conductors, and brakemen. Communications and office workers, including station agents and telegraphers, towermen, and telephonemen, coordinate the movement and direction of trains. They make up another fourth of all railroad workers. Railroads employed only a small number of porters, dining car waiters, and other passenger service attendants.

Equipment maintenance specialists, such as machinists, electrical workers, sheet-metal workers, carmen, boilermakers and blacksmiths, repair locomotives and cars. Right-of-way maintenance employees build and repair tracks, signals, bridges, and other structures. Together these maintenance workers accounted for more than one-third of railroad jobs.

The remaining workers were in the administrative division. These professional and clerical people, including clerks, accountants, and statisticians, handle ticket sales, freight receipts, personnel records, and other company records in stations and offices.

Discussions of the work, training, outlook, and earnings for most major occupations in railroads are presented in the statements that follow. Information on employment also is available in the statement on the railroad industry elsewhere in the *Handbook*. Details about specific jobs may be obtained from local railroad offices, and general information on the industry can be obtained from the Association of American Railroads, American Railroads Building, 1920 L St. NW., Washington, D.C.20036.

BRAKEMEN

(D.O.T. 910.364 and .884)

Nature of the Work

Brakemen work on passenger and freight trains and in railroad yards. Each train crew includes one brakeman stationed in the rear of the train who displays warning lights and signals to protect it while moving or stopped. For safety, all passenger and many freight trains carry at the front of the train another brakeman, who sets out signals to protect the front at unexpected stops.

Before departure, brakemen make sure that brake equipment is functioning properly and that tools, flares, and lanterns are in place. While under way, they regularly look for smoke, sparks, and other signs of sticking brakes, overheated axle bearings, and other faulty equipment. They may couple and uncouple cars and air hoses and help switch cars at sidings. In passenger service, brakemen (also known as trainmen) regulate car lighting and temperature; they may help the conductor by collecting tickets and assisting passengers. Yard brakemen (also known as switchmen or helpers) help assemble and disassemble trains by throwing switches, coupling and uncoupling cars, and operating car handbrakes.

Training, Other Qualifications, and Advancement

Beginning brakemen make several trips with an experienced brakeman or conductor to become familiar with the job duties. New brakemen are then put on the extra board and given assignments to substitute for workers who are absent for vacations, illness, or other reasons. Usually they work a year or so before they learn the job thorough-

ly, and several more years before they gain enough seniority to get a regular assignment.

Employers prefer applicants who are high school graduates or the equivalent. Good eyesight and hearing are essential. Physical stamina is necessary for the standing, walking, climbing, and exposure to all kinds of weather. Mechanical aptitude is helpful.

With sufficient seniority, brakemen may become conductors. These jobs are always filled by promoting experienced brakemen who have qualified by passing written and oral tests on signals, brake systems, timetables, operating rules, and other subjects. Since promotions are controlled by seniority rules, brakemen may wait 10 years or more to become conductors. Advancement is limited by the number of conductor jobs, and this number has been declining for many years.

Some brakemen in freight service may move to passenger service, usually considered more desirable because it is less strenuous. Some brakemen take positions as baggagemen, who tend baggage cars on passenger trains.

Employment Outlook

Employment of brakemen—who numbered nearly 73,000 in 1972—is expected to decline slowly through the mid-1980's. Some opportunities for new workers, however, will develop as experienced brakemen retire, die, advance to jobs as conductors, or transfer to other work.

Employment will continue to decline along with overall railroad employment. Employment will also be affected by increasing mechanization, as in automatic switches and automatic car identification systems using special labels that are read by wayside scanners. Changes in the size of train crews, eliminating one brakeman where there are now two, may further reduce job opportunities. The employment decline, however, may be less than anticipated if fuel shortages continue.

Earnings and Working Conditions

In 1972, brakemen had average monthly earnings of $940 in yard service, $1,190 in freight road service, and $1,190 in passenger road service. These earnings were about twice as much as the average for nonsupervisory workers in all private industries, except farming.

Brakemen usually work a 40-hour week, and receive premium pay for overtime. They often work nights, weekends, and holidays. Brakemen assigned to extra board work have less steady work, more irregular hours, and lower earnings than brakemen with regular assignments. Yard and freight service brakemen face greater accident risks than most other railroad workers.

Most brakemen are members of the United Transportation Union.

BRIDGE AND BUILDING WORKERS

Nature of the Work

Bridge and building workers construct and repair the tunnels, bridges, stations, shops, and other structures owned by the railroads. Included are carpenters, masons, bricklayers, plasterers, plumbers, painters, and ironworkers. (Details about the nature of work for these craftsmen can be found elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New employees usually begin as helpers. As openings occur in skilled jobs, qualified helpers who have the necessary seniority are promoted. Skilled bridge and building workers may advance to foremen, inspectors, or bridge and building supervisors.

Employment Outlook

Employment of bridge and building workers—who numbered about 10,500 in 1972—is expected to decrease slowly through the mid-1980's because of the continued decline in railroad employment. Additionally, productivity of workers will increase through the use of improved building materials that need less maintenance and of power tools and other laborsaving equipment. A small number of job openings will arise each year for new workers to replace those who retire, die, or transfer to other jobs.

Earnings and Working Conditions

In 1972, railroad carpenters in bridge and building work averaged $4.50 an hour. Masons, bricklayers, plasterers, and plumbers averaged $4.75; iron-workers, $4.82; painters, $4.52; helpers, $4.14; and foremen, $5.02 an hour.

Bridge and building workers work a 5-day, 40 hour week and receive premium pay for overtime. When they are on jobs away from home, they usually live in camp cars supplied by the railroads. Most of these jobs are active and strenuous and involve stooping, climbing, and lifting.

On most railroads, the Brotherhood of Maintenance of Way Employees represents bridge and building workers.

CLERKS

Nature of the Work

Railroad clerks handle paperwork to keep track of the company's cars and business with shippers and the traveling public. Clerks work in railroad stations, freight houses, yards, terminals, and company offices and make up the largest single group of railroad employees.

Most railroad clerks handle business transactions, such as collecting bills, adjusting claims, and tracing shipments. They use computers and other business machines in much of this work. In small offices and stations, a clerk may have many duties, but in large offices they tend to specialize in a few.

Other clerks are secretaries, stenographers, typists, and operators of calculating, bookkeeping, and other office machines. Their work is similar to the same occupations in other industries. (Information about these clerical occupations may be found elsewhere in the *Handbook*.)

Railroad clerks in higher grade jobs do more responsible or technical work. Some prepare statistics on employment, traffic, and other matters relating to railroad operations. Cashiers deal with customers on matters such as uncollected freight bills. Still others account for their company's use of jointly-owned terminals and other facilities.

Training, Other Qualifications, and Advancement

Most railroads require applicants for clerical jobs to have a high school education. They sometimes give clerical aptitude tests. Applicants who have training or experience in working with figures are preferred. In some clerical positions —yard clerk for instance—beginners may be assigned to extra board work until regular assignments become available. Extra board workers substitute for regular clerks who are absent because of vacations, illness, or other reasons.

In many offices, a railroad clerk may advance to assistant chief clerk or to a higher administrative position. In others, a clerk may move to jobs requiring special knowledge, such as accounting or statistics, and many eventually become an auditor or statistician. Some clerks are promoted to traffic agent, buyer, storekeeper, ticket agent, or station agent.

Employment Outlook

Employment of railroad clerks—who numbered nearly 83,000 in 1972—is expected to decline moderately through the mid-1980's, as railroad employment continues to decline. Computers and other labor-saving office equipment will increase the productivity of railroad clerks, and enable fewer clerks to do as much or more work than in the past. However, some job openings will arise as experienced clerks retire, die, or transfer to other fields of work.

Earnings and Working Conditions

In 1972, hourly earnings for railroad clerks who handled business transactions averaged $4.63, about one-fourth more than the average for nonsupervisory workers in all private industries, except farming. Secretaries, stenographers, typists, and office machine operators averaged $4.59 an hour; senior clerks and specialists averaged $5.32 an hour; and supervisory and chief clerks, $6.23 an hour. Railroad clerks usually work a 40-hour week, and receive premium pay for overtime.

Most railroad clerks are members of the Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees.

CONDUCTORS

(D.O.T. 198.168)

Nature of the Work

Conductors are in charge of train crews and are responsible for the safety of passengers and cargoes.

Before the train leaves the terminal, the conductor gets train orders from the dispatcher and makes sure that the crew understands them. During runs, conductors periodically inspect each car. If problems occur, they arrange either for repairs while under way or for removal of the defective cars at the nearest siding. At stops, they signal engineers when to depart.

On passenger trains, conductors collect tickets and provide information to passengers. On freight trains, they keep records of each car's contents and destination and see that cars are added and removed at the proper points along the route.

Yard conductors, or yard foremen, supervise the crews that assemble and disassemble trains. In many yards, they electrically control the track switches that are used to automatically classify cars on sidings.

Training, Other Qualifications, and Advancement

Experienced brakemen who have passed tests covering signals, timetables, operating rules, and related subjects are made temporary conductors until a regular opening occurs. Those who have the great-

est seniority become conductors. The availability of these positions limits promotion.

Most railroads maintain separate seniority lists for road service and yard service conductors and conductors usually remain in one type of service for their entire careers. On some roads, however, conductors start in the yards, then move to freight service, and finally to passenger service.

Conductors who have direct contact with the public must serve effectively as the railroad's representative. Those who show special abilities in this area may advance to managerial positions, such as trainmaster.

Employment Outlook

Employment of conductors—who numbered about 38,000 in 1972—is expected to decline slowly through the mid-1980's. Some brakemen, however, will be promoted to replace conductors who retire or die.

Employment of conductors will continue to decline in line with decreased industry employment, particularly as a result of reduced passenger traffic. Although some additional conductors will be needed for increased freight service, the number for yard service will decline because of widespread use of electric and electronic car classification systems and communications equipment. The employment decline, however, may be less than anticipated if fuel shortages continue.

Earnings and Working Conditions

In 1972, conductors had average monthly earnings of $1,120 in yard service, $1,350 in freight road service, and $1,337 in passenger road service. These earnings were more than double the average for nonsupervisory workers in all private industries, except farming.

Conductors usually work a 40-hour week and receive premium pay for overtime. They often work nights, weekends, and holidays. Temporary conductors frequently work irregular hours totaling less than 40 a week and, therefore, earn less.

Many conductors are members of the United Transportation Union.

LOCOMOTIVE ENGINEERS

(D.O.T. 910.383)

Nature of the Work

Engineers operate locomotives in passenger, freight, and yard services according to train orders or other instructions. Most run diesel locomotives; a few run electrics. To start the locomotive, they release the air brakes and pull the throttle. During the trip, they may operate other controls, such as light switches and windshield wipers, and watch gages and meters that measure fuel, electricity, and air pressure. They watch track signals that indicate track obstructions, speed limits, and special instructions. Engineers must have a thorough knowledge of the signal systems, yards, and terminals along their routes, and must be constantly alert to insure safe, efficient operation of trains.

Before and after each passenger and freight run, engineers check locomotives for mechanical problems. Minor adjustments are made on the spot, but major defects are reported to the engine shop foreman. Engineers must follow timetable schedules and consider passenger comfort and safety.

Training, Other Qualifications, and Advancement

Openings in engineer jobs are usually filled by training and promoting firemen according to seniority rules. Firemen qualify for promotion by demonstrating their ability to operate locomotives and by passing written and oral tests on mechanical and electrical equipment, fuel economy, safety, timetables, train orders, and other operating rules. A few railroads train brakemen and inexperienced workers for engineer jobs.

New engineers start as extra board workers and temporarily replace regular engineers who are absent because of vacation, illness, or other reasons. Extra board engineers frequently wait many years before earning enough seniority to get a regular assignment. Seniority rules also may determine the engineers' type of service; for instance, from a first regular assignment in yard service, they may move to freight service, and finally to passenger service.

Engineers take periodic physical examinations to determine fitness to operate locomotives. They must have keen eyesight and hearing. Those who fail to meet the physical

Engineer checks track conditions by radio.

standards are restricted to freight or yard service or transferred to other jobs with lower physical standards.

Employment Outlook

Employment of locomotive engineers—who numbered about 35,000 in 1972—is expected to show little or no change through the mid-1980's. Nevertheless, some openings will arise from the need to replace engineers who retire or die.

The number of engineers has been declining for many years owing to reduced passenger service and technological developments, with more powerful locomotives pulling longer trains. These developments, however, appear to have about run their course and will affect employment less in the future. Employment also may be favorably affected if fuel shortages continue.

Earnings and Working Conditions

The earnings of engineers depend on the kind of locomotive and type of service. In 1972, monthly earnings of engineers averaged $1,321 in yard service, $1,635 in freight road service, and $1,540 in passenger service. Engineers earned two to three times as much as the average for nonsupervisory workers in all private industries, except farming.

Yard engineers work 5 or more days a week, depending on the railroad. They receive premium pay for working more than 8 hours in any day.

Road service engineers often work nights, weekends, and holidays at regular pay. On many railroads, their earnings are limited by the maximum number of miles they can cover per month. Those who reach the limit are replaced by extra board engineers for the rest of the month.

Extra board engineers may work irregular hours since they may be called at any time. They are likely to have less work and, therefore, lower earnings than engineers on regular assignments.

Most engineers are members of the Brotherhood of Locomotive Engineers; some are members of the United Transportation Union.

LOCOMOTIVE FIREMEN

(D.O.T. 910.383)

Nature of the Work

Locomotive firemen work with and under engineers in both yard and road services. Before each run, they check the locomotive's working condition and supply of fuel, sand, and water. They may also have to make sure that emergency signaling tools and equipment, such as flares and lanterns, are ready to use.

During the train run, firemen watch for track obstructions and observe trackside signals that indicate speed limits. obstructions, and emergencies. As the train rounds curves, they look back for smoke, sparks, fire, and other signs of defective equipment, which they report to the engineer. They also make minor electrical and mechanical adjustments in the locomotive and operate the equipment that heats the passenger cars.

Training, Other Qualifications, and Advancement

Firemen are trained on the job by experienced engineers. During the training period, firemen make a

series of trips to learn their duties and railroad rules and regulations. The training lasts from one to six weeks and includes orientation sessions. After passing tests as required by individual railroads, they are assigned as firemen on regular jobs. If no regular job is available, they may be assigned as extra board workers to substitute for firemen who are absent because of vacations, illness or other reasons.

For firemen positions, railroads prefer applicants between age 21 and 35 years, who have a high school education. Applicants must have good hearing, eyesight, and color vision. Good eye-hand coordination, manual dexterity, and mechanical aptitude are also required.

Firemen are placed in engineer training programs within one year following their initial hiring date. They must then successfully complete an engineer training course of six months composed, in the most part, of classroom and on-the-job training in locomotive operation. They then become eligible for promotion to engineer in a maximum of 18 months after their first hiring as firemen. They take qualifying tests covering locomotive equipment, air brake systems, fuel economy, timetables, and operating rules and regulations. As engineers are needed, qualified firemen who have the longest seniority are placed on the engineers' extra board. Extra board engineers who do not have regular assignments substitute for regular engineers who are absent because of vacation, illness, or other reasons. Obtaining a regular position as an engineer may take several years depending on availability of jobs.

Employment Outlook

Employment of locomotive firemen —who numbered about 14,900 in 1972—is expected to decline rapidly through the mid-1980's. Some openings, however, will develop as experienced firemen retire, die, or are promoted to engineer positions.

Employment of firemen will decline faster than railroad employment as a whole. Although the outlook for this occupation has been uncertain, recent labor-management agreements provide procedures for hiring, training, and advancing firemen to locomotive engineer positions. As of July 1972, each railroad, depending on its number of engineers and miles covered, must have a minimum number of firemen available at all times. New firemen may have to be hired to meet these minimums.

Earnings and Working Conditions

Earnings of firemen depend on the kind of locomotive and type of service. In 1972, for example, monthly earnings of firemen averaged $960 in yard service, $1,262 in freight road service, and $1,292 in passenger road service. Firemen earned about twice as much as the average for nonsupervisory workers in all private industries, except farming.

Yard firemen work a 40-hour week and receive premium pay for overtime. The earnings of firemen in road service are limited by the maximum number of miles they are allowed to cover per month. Those who reach the limit are replaced by extra board firemen for the rest of the month.

Because trains run at all times, firemen often work nights, weekends, and holidays. Road service keeps them away from home for varying periods of time. Extra board firemen are likely to have less work and, therefore, lower earnings than firemen on regular assignments.

Many firemen belong to the United Transportation Union. Others are members of the Brotherhood of Locomotive Engineers (Ind.).

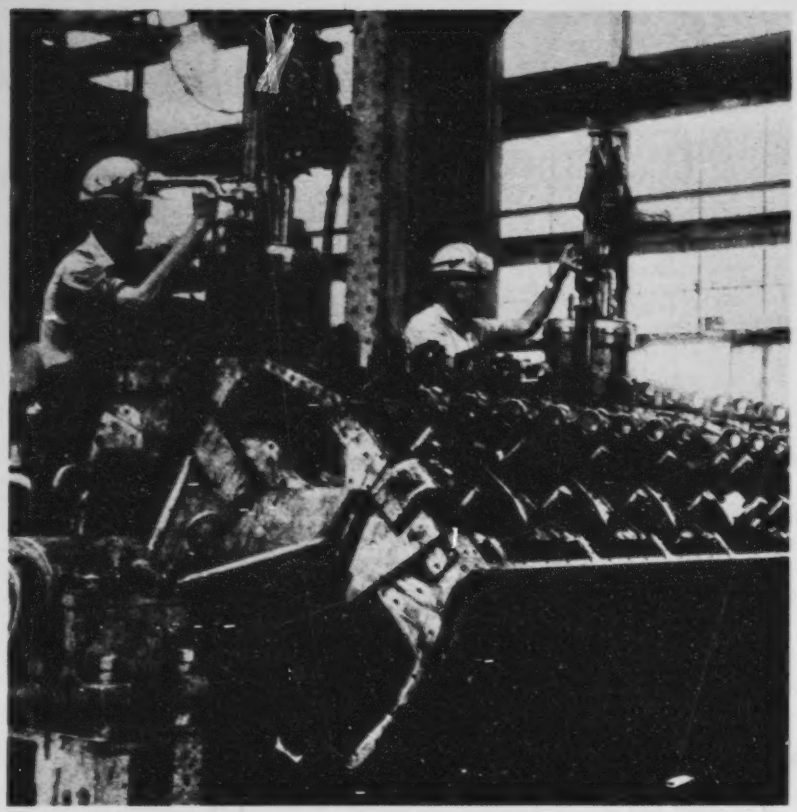
SHOP TRADES

Nature of the Work

The skilled workers who build, maintain, and repair railroad cars and other equipment may be classified in six main shop trades: carmen, machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.

Carmen (D.O.T. 622.381) build and repair freight and passenger cars, tank cars, and locomotives. They remove and inspect locomotive or car parts, such as wheels, brake assemblies, and air cylinders. They may also repair car interiors. Carmen use both power and handtools. Many carmen inspect cars for defects that might lead to accidents or delays.

Machinists (D.O.T. 600.280) service and overhaul locomotives and other equipment. *Electrical workers* (D.O.T. 721.381) install and maintain wiring and electrical equipment in locomotives, cars, and railroad buildings. Some lay and maintain power and communications lines. *Sheet-metal workers* (D.O.T. 804.281) install and maintain sheet-metal parts on locomotives and other equipment. *Boilermakers* (D.O.T. 805.281) service and repair stationary boilers, tanks, and other parts made of steel plates. *Blacksmiths* (D.O.T. 610.381) repair metal parts and tools. Other craftsmen include molders and pipers. (More information about most of these shop trades can be found elsewhere in the *Handbook*.)



Shop workers repair locomotive engine block.

Training, Other Qualifications, and Advancement

Although apprenticeship training is the most common way to enter shop trades, some helpers and laborers are upgraded to these jobs. Apprenticeships last 3 to 4 years, depending on how much previous work experience the apprentice has.

Most apprentices are between 16 and 21 years of age, although some are older at the start of their training. On some roads, apprentice applicants must pass mathematical and mechanical aptitude tests.

Some workers in the shop trades advance to positions as foremen in shops, engine houses, and powerplants.

Employment Outlook

Employment of journeymen shop trades workers—which in 1972 included about 42,000 carmen, 17,000 machinists, 11,000 electrical workers, 5,000 sheet-metal workers, 1,500 boilermakers, and 1,900 other craftsmen—is expected to decline slightly through the mid-1980's. Job openings, however, will develop for new apprentices or helpers as experienced workers retire, die, or transfer to other fields of work.

Earnings and Working Conditions

In 1972, hourly earnings averaged $4.96 for carmen, $5 for machinists, $5.04 for electrical workers, $5 for sheet-metal workers, $5.05 for boilermakers, and $4.98 for blacksmiths. Most shop workers have a 40-hour work-week, and receive premium pay for overtime.

Most shop work is done indoors. Some minor adjustments, inspections, and emergency repairs are done outdoors. Shop work is active and strenuous, involving stooping, climbing, and lifting.

Most shop workers are union members. Among the unions in this field are: Brotherhood of Railway Carmen of the United States and Canada; International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; Sheet Metal Workers' International Association; International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; and the International Brotherhood of Firemen and Oilers. These unions usually negotiate labor-management agreements through the Railway Employees' Department of the AFL-CIO.

SIGNAL DEPARTMENT WORKERS

(D.O.T. 822.281 and .884)

Nature of the Work

Railroad signal workers install and repair the communication and signaling systems that control train movement and assure safety. *Signalmen* construct and install new signals. They travel with work crews all over the railroad, wherever construction is underway. In erecting signals, these crews make forms and mix and pour concrete, weld metal, and do electrical work.

Signal workers must have good knowledge of electricity to keep signals working properly.

Signal maintainers keep wires, lights, switches, and other control devices in good operating condition. They must have a thorough knowledge of electricity and electronics.

Training, Other Qualifications, and Advancement

New employees are assigned as helpers to experienced workers. After about 60 to 90 days of training, helpers may advance to assistants. After another 2 to 4 years, qualified assistants may be promoted to signalmen and signal maintainers. Seniority rules control these promotions.

When hiring helpers, railroads prefer young applicants who are high school graduates or the equivalent. Applicants should have mechanical skill and a knowledge of electricity.

Both signalmen and signal maintainers may be promoted to signal inspectors or testmen, gang foremen, and higher supervisory positions. A few eventually become signal engineers.

Employment Outlook

Employment of signal department workers—who numbered about 11,000 in 1972—is expected to decline slightly through the mid-1980's. Improved signaling and communications systems that require less maintenance and repair will increase the productivity of signal department workers. Nevertheless, some job openings for new workers will arise as experienced workers retire, die, or transfer to other fields.

Earnings and Working Conditions

In 1972, signalmen and signal maintainers averaged $5.06 an hour, about one-third more than average for nonsupervisory workers in all private industries, except farming. Assistants averaged $4.25 an hour and helpers $4.13 an hour. Most signal workers have a 40-hour week, and receive premium pay for overtime.

Signal maintainers must make repairs regardless of weather conditions or time of day. Both signalmen and signal maintainers often climb poles and work near high-voltage wires.

On construction and installation jobs, signalmen and other crew members usually work away from home, and frequently live in camp cars provided by the railroads. Signal maintainers usually live at home, and service signals over a limited stretch of track.

Most signalmen and signal installers are members of the Brotherhood of Railroad Signalmen.

STATION AGENTS

(D.O.T. 211.468 and 910.138)

Nature of the Work

Station agents serve the public at railroad stations. Most agents work at small stations and sell tickets, check baggage, and compute freight and express charges. They also may telephone or telegraph train orders and other messages to train crews. At larger stations, many of these tasks may be done by clerks, telegraphers, and others who work under the agent's supervision. At major freight and passenger stations the agent's duties are primarily administrative and supervisory.

Training, Other Qualifications, and Advancement

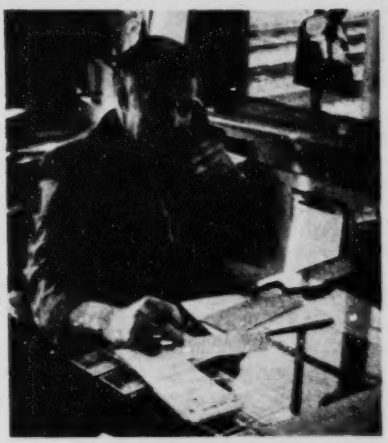
Station agents rise from the ranks of other railroad occupations. With sufficient seniority and ability, telephoners, telegraphers, towermen, and clerks may advance to agents in small stations or assistant agents in larger ones. Agents may be promoted from small to larger stations. They also may be promoted to supervisory positions such as station master or inspector.

Employment Outlook

Employment of station agents—who numbered about 8,700 in 1972—is expected to decline moderately through the mid-1980's as more passenger stations are closed. Nevertheless, a limited number of jobs will arise to replace experienced agents who retire, die, or stop working for other reasons. The employment decline may be less than anticipated if gasoline shortages continue and passenger travel by rail increases.

Earnings and Working Conditions

The earnings of station agents vary. In 1972, agents who also served as telegraphers and telephoners averaged $4.70 an hour, about one-fourth more than the average for nonsupervisory work-



Station agent checks list of train's cargo.

ers in all private industries, except farming. Agents in small stations who were not telegraphers averaged $4.98 an hour. Agents in major stations averaged $5.83 an hour. A 40-hour workweek is standard, and time and one-half is paid for overtime.

Station agents, except for some supervisory agents, are members of the Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees.

TELEGRAPHERS, TELEPHONERS, AND TOWERMEN

(D.O.T. 236.588 and 910.782)

Nature of the Work

Telegraphers, telephoners, and towermen control movement of trains according to instructions given by train dispatchers. They work in towers located in yards, terminals, and other important junction points.

Telegraphers and telephoners get orders from dispatchers and pass them on to train crews. Towermen operate controls that throw track switches and signals to route traffic. To some extent, the three jobs are interchangeable. For example, many towermen also transmit orders or operate signals.

Training, Other Qualifications, and Advancement

New telegraphers, telephoners, and towermen get on-the-job training that covers operating rules, train orders, and station operations. On most roads, trainees must pass examinations on train operating rules and demonstrate ability to use the equipment before they can qualify. Newly qualified workers usually are assigned to the extra board to work as substitutes for telegraphers, telephoners, and towermen who are absent for vacations, illness, or other reasons. After gaining enough seniority, they generally can bid for regular assignments.

Most railroads prefer applicants who are high school graduates or the equivalent. Good hearing and eyesight, including normal color vision, are required. Applicants should be responsible, alert, and capable of organizing thoughts and actions in emergency or pressure situations. They must be able to work in confined areas.

Some telegraphers, telephoners, and towermen may advance to positions such as station agent or train dispatcher.

Employment Outlook

Employment of telegraphers, telephoners, and towermen—who numbered about 11,000 in 1972—is expected to decline rapidly through the mid-1980's. Nevertheless, some new workers will be hired to replace experienced workers who retire, die or change occupations.

Employment in these fields will continue to decline as technological developments increase worker productivity. The wider use of mechanized yard operations, centralized traffic control, and other automatic signaling systems will continue to reduce employment.

Earnings and Working Conditions

In 1972, hourly earnings for telegraphers, telephoners, and towermen averaged $4.64, about one-fourth more than the average for nonsupervisory workers in all private industries, except farming.

A 40-hour week is standard, and time and one-half is paid for overtime. Under Federal law, railroad telegraphers generally cannot work more than 9 hours in any one day, except in emergencies.

Most telegraphers, telephoners, and towermen are members of the Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees.

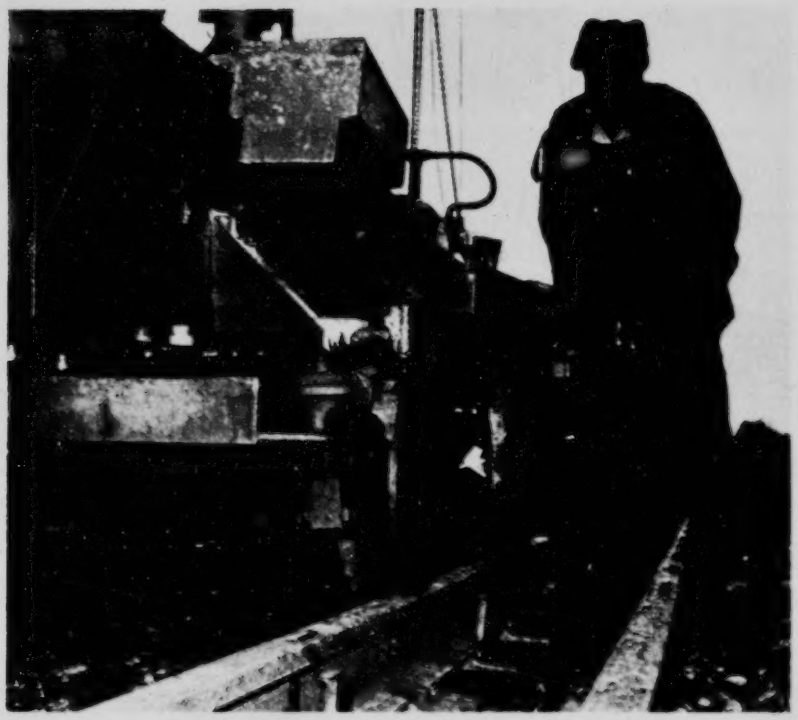
TRACK WORKERS

(D.O.T. 182.168, 859.883, 869.887, 910.782, and 919.887)

Nature of the Work

Trackmen construct, service, and repair railroad tracks and roadways. Many work in section crews that patrol and maintain a limited section of the railroad's right-of-way. Others in more mechanized crews cover longer stretches of the right-of-way. Extra crew members hired in the summer replace rails, and do other work that is difficult to do in winter.

Track workers regularly inspect the right-of-way, and look for cracked rails, weak ties, washed



Track maintenance worker drives spikes with pneumatic hammer.

out places, and other track and roadway defects. When laying, repairing, or replacing track, they operate small equipment, such as spike-driving machines, and use power tools as well as the familiar hand picks and shovels. Some operate large machines, such as cranes and bulldozers. Welders also are employed on track work.

Training, Other Qualifications, and Advancement

Most track workers learn their skills through on-the-job training that lasts about 2 years. Machine-operating jobs are assigned to qualified trackmen by seniority.

Railroads prefer applicants between the ages of 21 and 45, who can read, write, and do heavy work. Applicants may be required to pass physical examinations.

Some trackmen who have the necessary seniority and other qualifications may advance to gang or assistant foremen, then to positions such as track supervisor.

Employment Outlook

Employment of track workers—who numbered about 53,000 in 1972—is expected to decline slowly through the mid-1980's along with overall industry employment. Productivity of track workers will increase as machines do more and more of the work. Although several thousand workers will be hired each summer to do maintenance jobs that cannot be done during winter, few people will be hired for year-round jobs.

Earnings and Working Conditions

In 1972, track workers averaged $4.17 an hour, about one-seventh more than the average for nonsupervisory workers in all private industries, except farming. Equipment operators and helpers averaged $4.54 and crew foremen averaged $4.69 an hour. A 40-hour workweek is standard, and premium rates are paid for overtime.

Most track workers live at home. However, some crews travel from place to place, and live in camp cars or trailers provided by the railroads. Track workers have strenuous and active jobs. Much of the time they use moderately heavy tools and work in bent and stooped positions.

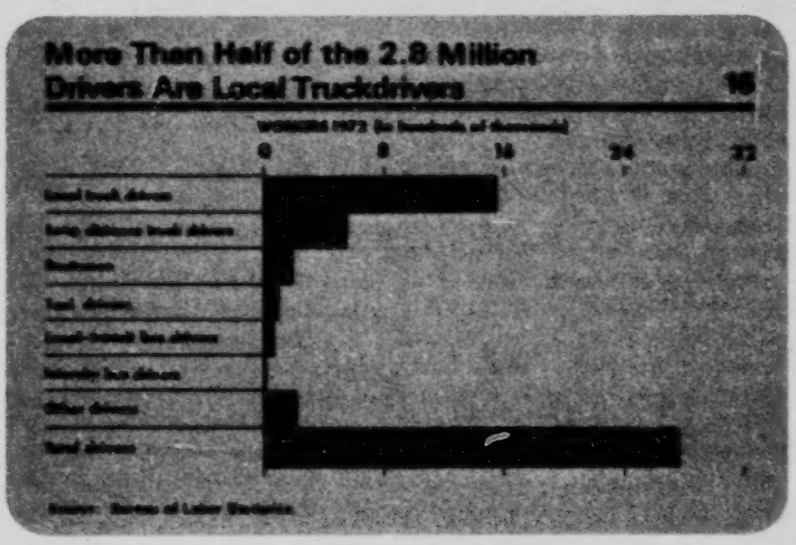
Most track workers are members of the Brotherhood of Maintenance of Way Employees.

DRIVING OCCUPATIONS

Nearly 2.8 million truck, bus, and taxi drivers moved passengers and goods over highways and city streets in 1972. Some drivers are behind the wheel practically all their working time. Others spend part of the time loading and unloading goods, making pick-ups and deliveries, and collecting money. Still others, like the routeman, are combination drivers-salesmen. (Routemen are discussed in the chapter on Sales occupations elsewhere in the *Handbook*.) The individual statements that follow cover long-distance and local truck drivers, intercity and local bus drivers, parking attendants, and taxi drivers. They do not cover school bus drivers, chauffeurs, ambulance drivers, or employees whose driving is incidental to their regular duties.

Through the mid-1980's, employment of long-distance and local truck drivers is expected to expand as more and more freight is moved by trucks. Employment in other driving occupations is not expected to change much, but many new employees will be hired to replace those who retire, die, or stop working for other reasons.

Driving jobs offer excellent opportunities for young persons who are not planning to attend college. The pay for most drivers is relatively high, and working conditions are fairly good. Many young persons also will enjoy the freedom from close supervision and the frequent contacts with people, which are characteristic of most driving jobs.



INTERCITY BUSDRIVERS

(D.O.T. 913.363 and 913.463)

Nature of the Work

In many smaller towns and cities, buses provide the only public transportation to other communities. In large cities, they are an alternative to railroad and airline transportation and in many cases, provide more frequent service.

Drivers' duties generally begin when they report to the terminal for their assignment. Before beginning their trips, they inspect the buses carefully. They make sure the brakes, steering mechanism, windshield wipers, lights and mirrors work properly. They also check the fuel, oil, water, and tires, and make certain that the buses are carrying safety equipment, such as fire extinguishers, first-aid kits, and emergency reflectors. Drivers also pick up tickets, change, report blanks, and other items needed for their trips.

For scheduled service, drivers move the buses from terminals or garages to the loading platforms, where they take on passengers. They collect fares—tickets usually—from the passengers as they board the buses and announce destination, route, time of arrival, and other information concerning the trips. Drivers may also either load or supervise the loading of baggage and freight.

If safety permits, drivers operate buses at speeds which will enable them to arrive at stations on time. At some stations, they stop only if they see passengers waiting or if they have been told to load or unload freight. They announce major stops and rest or lunch stops. Drivers also regulate lighting, heating, and air-conditioning equipment for the passengers' comfort.

In an emergency, they sometimes are required to make minor repairs such as changing tires.

Upon arriving at their final destinations, drivers may unload or supervise the unloading of baggage and freight. They prepare reports for their employers on mileage, time, and fares, as required by company rules. They also keep a log of work hours as required by the U.S. Department of Transportation. If an accident or unusual delay occurs, drivers must make a complete report.

At times drivers operate chartered buses. In these cases, they pick up a group of people, take them to the group's destination, and remain with them until they are ready to return. These trips frequently require drivers to remain away from home one or more nights.

Places of Employment

Approximately 25,000 intercity busdrivers were employed by about 1,000 bus companies in 1972. Few were women. Intercity busdrivers are employed throughout the Nation. Some work out of terminals in the many small communities served by bus, but most report for work at the major terminals in large cities.

Training, Other Qualifications, and Advancement

All intercity busdrivers are required to meet minimum age, health, and experience qualifications established by the U.S. Department of Transportation. The minimum age requirement is 21 years. Applicants must be able-bodied and have good hearing and at least 20/40 eyesight, without glasses, corrected to 20/20 with glasses. One large company requires 20/30 vision corrected to 20/20 with glasses. Applicants cannot be hired who have serious heart trouble or other physical problems that could endanger passengers. Drivers must be able to read and speak English.

Many intercity bus companies, however, have considerably higher requirements. Most prefer applicants to be at least 24 years of age and to have a high school education or its equivalent. Applicants often must pass comprehensive examinations to determine their driving skill in the type of bus they will operate.

An even temperament and emotional stability are important qualifications because busdrivers work under considerable tension when they operate large vehicles in heavy and fast moving traffic. Since they represent their companies in dealing with passengers, busdrivers also must be courteous and tactful.

Although previous experience in driving a truck or bus is not required, it is preferred by some employers. In many States, the trainee for a busdriver's job must have or obtain a chauffeur's license, which is a commercial driving permit.

Most intercity bus companies conduct training programs for new drivers. These programs, which usually last from 2 to 6 weeks but can extend to 3 months, include both classroom and driving instruction. In the classroom, trainees learn about the company and U.S. Department of Transportation rules, State and municipal regulations, safe driving practices, ticket prices, timetables, and conduct in dealing with the public. They also learn how to keep records, inspect the bus, and make minor repairs.

After completing classroom work, trainees ride with regular drivers to observe safe driving practices and other aspects of the job. They also make trial runs, without pas-

sengers, to improve their driving skill. After completing the training, which includes final driving and written examinations, new drivers begin a "break-in" period. During this period, working under strict supervision, they make regularly scheduled trips with passengers.

New workers start out on the "extra board," which is a list of drivers who are given temporary assignments. While on this list, they may substitute for regular drivers who are ill or on vacation, or drive chartered buses. Extra drivers may have to wait several years before they have enough seniority to get a regular assignment. In almost all companies, beginners must serve a probationary period that lasts from 30 to 90 days.

Opportunities for promotion generally are limited, particularly in small companies. Experienced drivers may be promoted to jobs as dispatchers, supervisors, or terminal managers. For most drivers, advancement consists of receiving better assignments with higher earnings as their seniority increases.

Employment Outlook

Little or no change in the number of intercity busdrivers is expected through the mid-1980's. Several hundred job openings, however, will become available each year because of the need to replace experienced drivers who retire or die. Additional openings will arise as some drivers transfer to other occupations.

Because of competition from airlines and private automobiles, intercity bus travel is not expected to grow significantly. Moreover, new and improved highways make it possible for drivers to make runs in less time, thus reducing the need for additional drivers.

Earnings and Working Conditions

Drivers employed by large intercity bus companies had estimated annual average earnings of $12,500 in 1972, or about two-thirds more than the average for all nonsupervisory workers in private industry, except farming. The wages of intercity busdrivers typically are computed on a mileage basis but short runs may be on an hourly rate. Mileage rates ranged from 16 to 18 cents a mile in 1972. Most regular drivers are guaranteed a minimum number of miles or hours per pay period. For work on other than regular assignments they receive additional pay, customarily at premium rates.

Extra drivers usually are paid by the hour when they are on call but not driving, and are paid the regular mileage or trip rate when actually driving. They generally earn slightly less than regular drivers but, if enough work is available, they may earn as much or more. Extra drivers usually receive a weekly or biweekly guarantee either in minimum hours, mileage, or earnings.

Most drivers who work for the large companies average less than 39 hours of work a week. Driving schedules may range from 6 to 10 hours a day and from 3½ to 6 days a week. U.S. Department of Transportation regulations specify that intercity drivers may drive no more than 10 hours without having at least 8 hours off.

Most intercity busdrivers belong to the Amalgamated Transit Union. The Brotherhood of Railroad Trainmen, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) also have organized these workers in some areas of the country.

Union contracts covering many intercity busdrivers provide for health and life insurance paid by the employer; pension plans under such agreements are usually financed jointly by the workers and their employers.

Drivers receive paid vacations ranging from 1 to 5 weeks, depending on the company for which they work and their length of service. Many also receive a minimum of 8 paid holidays annually. When away from home overnight, drivers receive pay for food and lodging, or accommodations may be provided.

Driving an intercity bus usually is not physically difficult, but it is tiring and requires steady nerves. The busdriver is given a great deal of independence in his job, and is solely responsible for the safety of the passengers and bus. Many drivers like working without direct supervision and take pride in assuming these responsibilities. Some also enjoy the opportunity to travel and to meet the public.

Among the less desirable aspects of this job are weekend and holiday work and the need for being away from home for varying periods. Also, extra drivers are on call at all hours and may be required to report for work on very short notice.

Sources of Additional Information

For further information on job opportunities in this field, contact intercity bus companies or the local office of the State employment service.

LOCAL TRANSIT BUSDRIVERS

(D.O.T. 913.363 and 913.463)

Nature of the Work

Local transit busdrivers transport

millions of Americans to and from places of work and various other destinations every day. These drivers follow definite time schedules and routes over city and suburban streets to get passengers to their destinations on time.

The workday for local busdrivers begins when they report to the terminal or garage. There, they receive assignments, transfer and refund forms and obtain their buses. Drivers check tires, brakes, windshield wipers, and lights before starting their runs. Those who work for small bus companies also may check the water, oil, and fuel.

On most runs, drivers make regular stops every block or two. As the passengers board the bus, they make sure the correct cash fare, token or ticket is placed in the fare box. They also collect or issue transfers. Drivers often answer questions about schedules, routes, and transfer points, and sometimes call out the name of the street at each bus stop.

At the end of the day, busdrivers turn in trip sheets which usually include a record of fares received, trips made, and any delays in schedule. In cases of an accident or unusual delay, drivers must make out a report on its nature and cause.

Places of Employment

About 68,000 local busdrivers were employed in 1972; a small proportion were women. More than one-half of the total worked for publicly owned transit systems and most of the remainder worked for privately owned bus lines. A small number worked for sightseeing companies.

Although many drivers are employed in large metropolitan areas, such as New York and Chicago, some are employed in almost every city in the Nation.

Training, Other Qualifications, and Advancement

Applicants for busdriver positions should be between the ages of 21 and 40, be of average height and weight, and have good eyesight—with or without glasses. Applicants must be in good health and must pass the written and physical examinations given by most employers. Because drivers often work under pressure and deal with many different personalities, emotional stability is important. Although educational requirements are not high, many employers prefer applicants who have a high school education or its equivalent.

A motor vehicle operator's license, and generally, 1 or 2 years of driving experience on some type of motor vehicle are basic requirements. A good driving record is essential because the busdriver is responsible for passenger safety. Most States require busdrivers to have a chauffeur's license.

Most local transit companies conduct training courses which may last several weeks and include both classroom and driving instructions. In the classroom, the trainees learn company rules, safety regulations, and safe driving practices. They also learn how to keep records and how to deal tactfully and courteously with passengers. Driving instruction consists of supervised trips both with and without passengers. At the end of the course, trainees may have to pass a written examination and a driving examination.

After passing the examinations, new drivers are often placed on an "extra" list to substitute for regular drivers who are ill or on vacation and to make extra trips during

morning and evening rush hours. They also may drive charter or sightseeing runs and other extra runs such as special buses for taking passengers to sporting events. They remain on the extra list until they have enough seniority to get a regular run, which may take several months or more than a year.

Opportunities for promotions generally are limited, although experienced drivers may advance to jobs such as instructor, dispatcher, and sometimes bus company executive. Promotion in city owned bus systems is usually by examination.

Employment Outlook

Employment of local busdrivers is expected to increase slowly through the mid-1980's. Most job openings, however, will result from the need to replace drivers who transfer to other occupations, retire, or die.

The increased use of privately owned automobiles in cities and the population shift to the suburbs where most people drive their own cars has caused a decline in bus passengers and driver employment. However, in urban areas the automobile is now recognized as the main source of air pollution and traffic congestion. To reduce the number of cars used by commuters, local bus service is being improved in many cities. Express lanes reserved for buses on city streets, more convenient routes and more comfortable buses reflect the impact of Federal, State and local government interest and expenditures in providing better bus service. As service improves, bus passengers and driver employment are both expected to increase.

Earnings and Working Conditions

According to a survey of union contracts in 65 large cities, local busdrivers averaged $4.62 an hour in 1972, about one-fourth more than the average for all nonsupervisory workers in private industry, except farming. Hourly wages were highest in the larger cities. Wage scales for beginning drivers were generally 5 to 15 cents an hour less.

Most local busdrivers have a standard work schedule of 8 hours a day, 40 hours a week. For additional work, drivers usually receive 1½ times their hourly rates. In many companies, drivers often work overtime, thereby increasing their weekly earnings. Drivers on the extra list generally are guaranteed a minimum weekly salary.

The workweek for regular drivers usually consists of any 5 consecutive days; Saturdays and Sundays are counted as regular workdays. Some drivers have to work at night.

To accommodate the demands of commuter travel, many local busdrivers have to work "split shifts." For example, a driver may work from 6:00 a.m. to 10:00 a.m., go home and then return to work from 3:00 p.m. to 7:00 p.m. Drivers may receive extra pay for split shifts. Other assignments are "straight runs" which are unbroken except for meal periods. Some union contracts require 50 to 60 percent of all assignments to be straight runs.

Nearly all local transit busdrivers are covered by labor-management contracts that provide for life and health insurance and pension plans. Also, drivers are given vacations with pay ranging from 1 to 5 weeks or more, depending on their length of service, and usually 6 or 7 paid holidays a year.

Driving a bus is not physically strenuous, but busdrivers may suffer nervous strain from maneuvering a large vehicle through heavy traffic while dealing with passengers. Local busdrivers enjoy steady year-round employment, and work without close supervision.

Most local busdrivers are members of the Amalgamated Transit Union. Drivers in New York City and several other large cities belong to the Transport Workers Union of America. The Brotherhood of Railroad Trainmen and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) also have organized some local busdrivers.

Sources of Additional Information

For further information on employment opportunities, contact a local bus company or the local office of the State employment service.

LOCAL TRUCK DRIVERS

(D.O.T. 900.883, 902.883, 903.883, 906.883, and 909.883)

Nature of the Work

Local truck drivers move goods from terminals and warehouses to wholesalers, retailers, and consumers in the area. They must be skilled drivers who can maneuver trucks into tight parking spaces, through narrow alleys, and up to loading platforms.

When local truck drivers report to work at a terminal or warehouse, they receive assignments to make deliveries, pickups, or both. They also receive delivery forms and check the condition of their trucks. Platform men generally load trucks and arrange the items in the proper delivery sequence for minimum handling. At customer's places of business, drivers generally load and unload the merchandise. If there are heavy loads such as machinery, or if there are many deliveries to

make during the day, a driver may have a helper. Drivers of moving vans usually have crews of helpers to assist in loading and unloading household or office furniture.

At the delivery points, drivers get customers to sign receipts and freight bills, and may receive money for the material delivered. At the end of the day, they turn in receipts and monies and records of the deliveries made. They also report whatever maintenance or repair is needed before their trucks are used again.

Some of these workers drive special types of trucks, such as dump or oil trucks, which require the operation of mechanical levers, pedals, or other equipment. If they haul large or heavy items, they operate mechanical hoists to load and unload the trucks.

Places of Employment

About 1.6 million workers were employed as local truck drivers in 1972, mostly in and around large metropolitan areas. However, they work in all localities.

Most local drivers work for businesses which deliver their own products and goods—such as department stores, meatpackers, wholesale distributors, and construction companies. Many others are employed by local for-hire operators—trucking companies that serve the general public or specific companies under contract. Some are employed by the Federal Government, the Postal Service, and by States and municipalities.

A large number of local truck drivers are self-employed. Drivers who own one or two trucks account for a sizeable proportion of the local for-hire trucking business.

Training, Other Qualifications, and Advancement

Qualifications for local truck drivers vary considerably, depending upon the type of truck and the nature of the employer's business. Some employers prefer those who have completed 2 to 4 years of high school. Applicants must be able to lift heavy objects and otherwise be in good health. They should be 21 years of age and have good hearing and at least 20/40 vision, with or without glasses. Since a driver often deals directly with the public, the ability to get along well with people also is important.

An applicant must have a chauffeur's license, which is a commercial driving permit. Familiarity with traffic laws and safety measures is necessary, and some previous experience in driving a truck is helpful. Young people may obtain such experience by working as a truck driver's helper. Employers also give consideration to driving experience gained in the Armed Forces.

An applicant may have to pass a general physical examination, a written examination of driving regulations, and a driving test. Employers generally check applicants for traffic and police records.

Training given to new drivers is often informal, and may consist only of riding with and observing an experienced driver. Additional training may be given if they are to drive a special type of truck. Some companies give a 1 to 2 days' indoctrination course which covers general duties, the efficient operation and loading of a truck, company policies, and the preparation of delivery forms and company records.

Although most new employees are assigned immediately to regular driving jobs, some start as extra drivers, covering the routes of regular drivers who are ill or on vacation, or making extra trips when necessary. They receive regular assignments when openings occur.

Local truck drivers may advance

to supervisor, dispatcher, manager, or to traffic work—for example, in planning delivery schedules. However, these jobs are relatively few. For the most part, a local truck driver may advance by driving heavy or special types of trucks or by transferring to long distance truck driving.

Experienced truck drivers who have business ability can start their own trucking companies when they have enough money.

Employment Outlook

A moderate increase in the employment of local truck drivers is anticipated through the mid-1980's. In addition to the job openings from growth, many openings will result from the need to replace experienced drivers who transfer to other occupations, retire, or die.

The rise in total business activity anticipated in the years ahead will increase the amount of freight. Since trucks carry virtually all local freight, employment of drivers will grow but not as fast as the increase in freight. In many cases, trucks are not fully loaded when they make deliveries; thus, more goods can be handled without increasing the number of trucks or drivers. In addition, the trend to large shopping centers rather than many small stores will reduce the number of deliveries required. The use of radio telephones to instruct drivers enroute will also reduce the time needed for deliveries.

Earnings and Working Conditions

On the average, hourly union wage scales were $5.49 for local truck drivers and $4.90 for helpers in 1972 according to a survey in 68 large cities. This is about one-half more than the average for all nonsupervisory workers in private industry, except farming.

As a rule, local truck drivers are paid by the hour and receive extra pay for working overtime, usually after 40 hours. Some drivers are guaranteed minimum daily or weekly earnings. Local truck drivers frequently work 48 hours or more a week. Night or early morning work is sometimes necessary, particularly for drivers handling foodstuffs for chain grocery stores, produce markets, or bakeries. Most drivers deliver over regular routes, although some may be assigned different routes each day.

Local truck drivers generally have paid vacations of 1 or 2 weeks after a year of service, and of up to 4 weeks after 15 years. In addition, they usually receive pay for seven or more holidays annually.

Among unions organizing local truck drivers are the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some local truck drivers employed by private carriers are members of unions that represent the plant workers of their employers.

Practically all unionized local truck drivers and their helpers are covered by life and health insurance and pension plans provided by the union from employer contributions. When uniforms are required, the cost usually is paid for entirely or partly by the employer, who also may provide for their upkeep.

Local truck drivers, because they drive in heavy traffic, are subject to nervous strain. Truck driving has become less physically demanding because of power steering, more comfortable seating, and other improvements. However, when local drivers make many deliveries during a day, their work can be exhausting. Some drivers may develop physical disorders, such as back strain and hernia. Local truck drivers, however, do have certain work advantages. Employment is steady and, unlike long distance drivers, they usually work during the day and return home in the evening.

Sources of Additional Information

Information on career opportunities may be obtained from:

American Trucking Association, 1616 P St. NW., Washington, D.C. 20036.

For details on truck driver employment opportunities, contact local trucking companies, or the local office of the State employment service.

LONG-DISTANCE TRUCK DRIVERS

(D.O.T. 903.883, 904.883, 905.883, and 909.883)

The drivers of the big trucks on highways and turnpikes are skilled and experienced professionals. They operate large tractor-trailers that carry goods hundreds or even thousands of miles.

Typically, long-distance truck drivers report to the terminal early in the evening and receive assignments to take a truck to a terminal in a city hundreds of miles away. Night travel is preferred because the roads are less crowded and trips take less time. The truck trailer already has been loaded and the tractor serviced with fuel and oil.

Before moving from the terminal, drivers inspect the trucks to make sure they will operate safely and that they contain a fire extinguisher, flares, and other safety equipment. They also make sure the cargo has been loaded safely and will not shift while trucks are moving.

Drivers must be careful when going through narrow spaces to allow enough room in turns for the long trailers. Since truck seats are higher than seats in most cars, drivers can see far down the road. They seek traffic lanes that allow trucks to move at a steady speed, and when going downhill they may increase speed slightly to gain momentum for a hill ahead.

Enroute, drivers may stop to assist motorists who are involved in accidents or who have car trouble. They frequently put flares along the road to warn other drivers of danger. After several hours, drivers may stop for fuel or for rest and conversation with others. In the early morning when drivers have reached their destination and parked at the unloading platform, they complete trip logs and reports on the condition of the truck. Both are required by the U.S. Department of Transportation. When drivers have an accident, a detailed report is required. Drivers are generally off-duty the evening before they pick up another truck to drive back to their home city, or in some cases, to another city.

Long-distance truck drivers spend most of their working time behind the wheel, although some also handle freight. For example, a driver may have to unload a store's cargo at night when receiving crews are not available. Helpers assist drivers of long-distance moving vans in loading and unloading furniture.

Places of Employment

An estimated 570,000 long-distance drivers were employed in 1972. Very few were women. Most live near cities and manufacturing centers which have many truck terminals. Drivers who specialize in transporting agricultural products or minerals may live in rural areas.

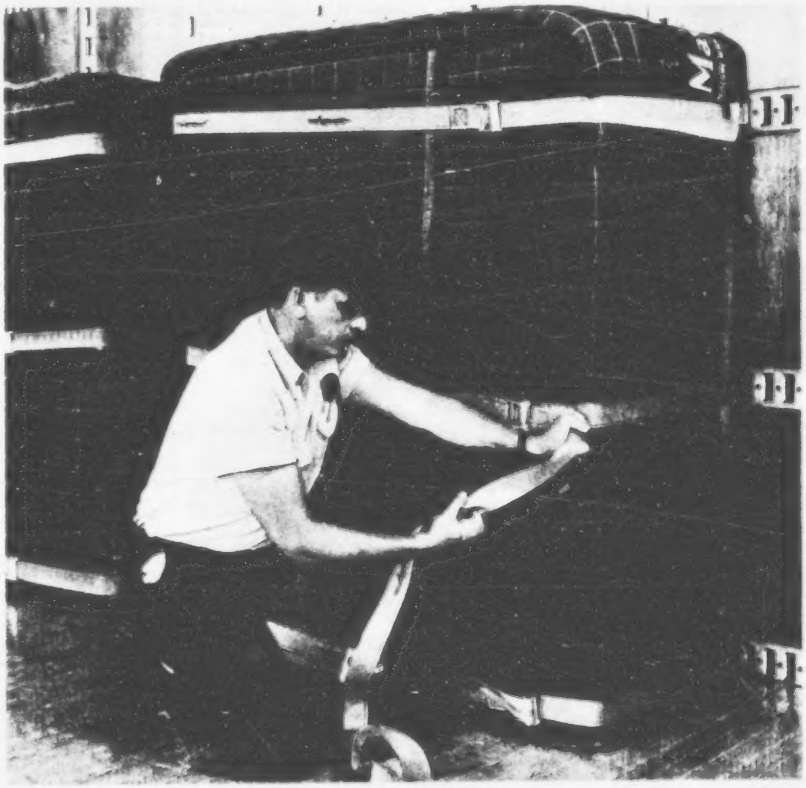
The majority of long-distance truck drivers work for large common carriers—trucking companies that serve the general public. Most others work for trucking firms that haul goods under contract or for private carriers; such as steel companies, which use their own trucks.

Training, Other Qualifications, and Advancement

The U.S. Department of Transportation establishes minimum qualifications for long-distance truck drivers engaged in interstate commerce. A driver must be 21 years old and pass a physical examination which the employer usually pays for. Good hearing, 20/40 vision with or without glasses, normal use of arms and legs (unless a waiver is obtained), and normal blood pressure are the main physical requirements.

Drivers must be able to read, speak, and write English well enough to make required entries on reports and records. They must have a good driving record. Before being hired, drivers must pass a road test to show they can operate a vehicle of the type and size they will drive in regular service. In addition, they must pass a written examination on the Motor Carrier Safety Regulations of the U.S. Department of Transportation. In most States, truck drivers also must have a chauffeur's license from the State Motor Vehicle Department.

Many fleet operators have higher hiring standards than those described. Many firms will not hire



Driver ties down cargo.

drivers under 25 years old; some specify height and weight limitations; many require at least a high school education; and others require 2 years of high school. Some companies employ only applicants who have had several years' experience driving long-distance trucks.

Young persons may begin as helpers to local truck drivers, assist in loading and unloading, and occasionally do some relief driving. Most drivers have had experience in local trucking before attempting long-haul driving which is a senior driving job. Then, after gaining experience, they drive larger and more complicated trucks.

Driver training is a common method of preparing for truck driving jobs. Most training authorities and employers recommend high school driver-training courses. If such courses are not available, driving schools in most large cities are recommended. A high school course in automotive mechanics helps the driver to make minor roadside repairs and to know when a truck is not operating properly.

A small number of private technical-vocational schools and some State and community colleges offer truck driving courses which emphasize safe-driving practices. In these courses, students learn to care for equipment and freight, to drive large vehicles in small spaces and in highway traffic, and to comply with Federal, State, and local regulations.

All employers are interested in obtaining good, safe, reliable drivers but the method of selection varies. Some use aptitude tests; others hire on the basis of personal interviews. New drivers are usually given a brief indoctrination course covering company policy and the preparation of various forms used on the job. They then make one or more training trips under the supervision of an instructor or an experienced driver.

Drivers employed by common carriers frequently start on the "extra board," bidding for regular runs on the basis of seniority as vacancies occur. (The extra board is a list of drivers, assigned in rotation, who substitute for regular drivers or who make extra trips when necessary.) Drivers for private carriers are more likely to begin with assigned regular routes.

Opportunities for promotion in this occupation are limited. A few drivers may advance to jobs as safety supervisors, driver supervisors, and dispatchers. However, such jobs are often unattractive to long-distance truck drivers, since the starting pay is usually less than the pay for driving jobs. Most drivers can only expect to advance to driving runs that provide increased earnings or preferred schedules and working conditions.

Employment Outlook

Employment of long-distance truck drivers is expected to increase moderately through the mid-1980's as the volume of intercity freight grows. In addition to jobs from employment growth a large number of openings will be created as experienced drivers retire, die, or transfer to other fields of work.

The general economic growth of the Nation is expected to increase the amount of freight carried long distances by truck. In addition, many new factories, warehouses, and stores are being located in suburban or semirural areas where rail facilities are nonexistent or extremely limited.

Earnings and Working Conditions

Drivers employed by large common carriers of general freight had estimated annual average earnings of $15,800 in 1972, about double the average of all nonsupervisory workers in private industry, except farming. Pay rates are fairly uniform because this field is highly unionized, and union contracts are generally master agreements covering all employers within a multi-State region.

The earnings of an individual driver are affected by mileage driven, number of hours worked, type of truck and the weight of loads. Earnings also are affected by the nature of the cargo; premium rates are paid for flammable or otherwise hazardous commodities.

Some private carriers pay drivers on the same basis as other employees—a monthly, weekly, or daily wage. Generally, such a wage is for a specified number of hours, and, if the driver works additional hours, he receives extra pay.

Motor carriers engaged in interstate commerce are subject to the U.S. Department of Transportation rules governing hours of work and other matters. These regulations limit the hours intercity drivers may work and assure a reasonable amount of time for rest. For example, no driver may be on duty for more than 60 hours in any 7-day period, and no driver may drive more than 10 hours without being off-duty at least 8 hours. Many drivers, particularly on very long runs, work fairly close to the maximum hours permitted. A workweek of at least 50 hours is very common.

Most drivers receive 8 or more paid holidays each year, and 1 to 4 weeks of vacation with pay depending on their length of service. Most employers contribute to employee health insurance and pension plans.

Long-distance truck drivers often must spend time away from home.

In such instances, the company provides lodging either in a company dormitory or a hotel. Some companies use two drivers on very long runs. One drives while the other sleeps in a berth behind the cab. Although earnings on sleeper runs are the highest in the field, few drivers stay with this type of run very long. The work is very tiring and requires being away from families and friends for days and even weeks.

The earnings of drivers of long-distance moving vans are quite high, but their hours are long and the work is strenuous. They drive more miles than the average long-distance driver and also work more hours in loading and unloading goods.

The physical strain of intercity truck driving has been reduced by more comfortable seating, better highways, and more stringent safety regulations. Sitting in one place for hours at a time, however, is tiring and the nervous strain of sustained driving is fatiguing.

Intercity trucking has a lower accident rate than in other forms of motor transportation largely because of intensive safety programs and skilled drivers.

Most long-distance drivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some drivers of private carriers belong to the unions that represent plant employees of the companies for which they work.

Sources of Additional Information

Information on career opportunities may be obtained from:

American Trucking Association, 1616 P St. NW., Washington, D.C. 20036.

Additional details on truck driver employment opportunities may be obtained from local trucking companies or local offices of the State employment service.

PARKING ATTENDANTS

(D.O.T. 915.878)

Nature of the Work

Parking attendants move cars in and out of parking spaces at commercial and private parking facilities. At commercial lots, the attendant meets incoming cars, records the time of arrival on a numbered claim ticket, gives the driver part of the ticket, and puts the other part in some clearly visible place on the car. Some establishments use a three-part claim ticket. In such cases, the attendant notes the car's parking space on the third part which is filed in the office. This procedure eliminates the attendant's looking for the car when the customer returns. Still other facilities use a "time plan" for handling cars. Under this system, customers are asked the time they expect to return, and parking spaces are allocated to reduce the number of cars that must be moved when the customer returns.

In both commercial and private lots, the attendant drives the car to a vacant space or tells the driver where to park. At multilevel parking garages, some attendants may drive cars up and down the ramps; others park and retrieve cars on a particular floor. In a single level parking lot or garage, the attendant walks back to the entrance after he has parked the car. However, in many multilevel garages a moving manlift belt transports him to and from any floor.

In some commercial lots and garages, the attendant meets returning customers, tallies the parking charge, collects the fee, and retrieves the car. In large establishments, however, customers usually pay a cashier. The cashier gives the claim ticket to an attendant, who then retrieves the car.

Slack periods are common at most facilities. Some car parkers, therefore, may be expected to take on routine maintenance jobs around

Attendant explains fees.

the lot or garage, or to wash and wax cars.

Places of Employment

In 1972, approximately 33,000 parking attendants worked full time; thousands more were employed part time. Many part-time attendants are students.

Parking attendants work at facilities that vary from small outdoor lots to vast multilevel parking garages. Most parking establishments are commercial, but some private facilities are maintained by restaurants, hotels, airports, or stores. Others are municipally owned and operated.

Training, Other Qualifications and Advancement

Although there are no specific educational requirements for parking attendants, employers prefer high school graduates. Parking attendants must have a valid driver's license and be skillful in handling all types of cars. Clerical and arithmetic skills are helpful for attendants who keep records of claim tickets, compute parking charges, and make change.

Attendants also should be in good physical condition because the work involves long periods of standing and can be tiring during busy times. Parking attendants should be neat, tactful, and courteous when dealing with the public.

Many organizations have on-the-job training programs that improve the attendant's car handling ability and familiarize him with good customer relations, company policy, and record keeping procedures.

Car parkers have limited opportunities for advancement, although they may become managers or supervisors of a parking facility. Frequently, attendants use their driving skill to switch to related jobs such as truck driver, chauffeur, or routeman.

Employment Outlook

Employment of parking attendants is expected to grow slowly through the mid-1980's as most new facilities use the self-parking system. Commercial parking owners prefer the less costly self-park method and many customers prefer to park their own cars. Traffic flows faster in a self-park lot because attendants do not have to handle incoming and outgoing cars.

Despite the anticipated slow growth in the occupation, some openings are expected each year, chiefly to replace those who die, retire or transfer to other jobs. Most opportunities will be in large commercial parking facilities in the downtown areas of big cities.

Earnings and Working Conditions

Although they usually are not covered by minimum wage provisions, in 1972 most inexperienced parking attendants had hourly earnings near the $1.60 minimum required by State and Federal laws. Some attendants who worked in large urban areas earned between $3 and $3.60 an hour. According to the limited data available, in 1972 most experienced parking attendants had earnings that were below the average for all nonsupervisory workers in private industry, except farming. Tips, which are common in this occupation, can boost regular earnings substantially.

Many car parkers receive fringe benefits such as life, health, and disability insurance; paid vacations; a Christmas bonus; and profit sharing. Some companies furnish uniforms. On the other hand, attendants often work long hours. A 10-hour day and work at nights, on weekends, and on holidays are not unusual. In addition, many car parkers spend much time outdoors in all kinds of weather and constantly breathe automobile exhaust fumes. In some places, attendants are responsible for any damage they do to customers' cars.

Sources of Additional Information

For general information about the parking industry write:

National Parking Association, 1101 17th St. NW., Washington, D.C. 20036.

TAXI DRIVERS

(D.O.T. 913.363)

Nature of the Work

In practically all communities, taxicabs are an essential part of the public transportation system. They offer individualized service not otherwise available, since they operate without fixed routes or schedules.

Many taxicab companies have cabs with two-way radios so dispatchers can tell drivers where to pick up passengers who call for service. Also, drivers may wait at cabstands for telephone calls from the dispatching office. In suburbs and small cities, drivers usually work from a central station and return to it after each trip unless they are called by the dispatcher or are hailed by passengers along the way. Drivers in large cities may drive around busy areas and watch for potential customers or may wait at hotels, bus terminals, and other places where business will be good. Smart drivers keep informed on

where crowds are likely to gather in the city (for example, at conventions), so that they can be on hand to pick up passengers when they leave.

Occasionally, taxicab drivers may assist passengers in and out of the cab and may handle their luggage. In some communities, drivers regularly transport crippled children to and from school. Cab drivers also may provide sightseeing tours for out-of-town visitors and also may pick up and deliver packages.

Drivers have to keep records of such basic facts as the date, time, and place passengers were picked up, and their destination, time of arrival, and amount of fare. Self-employed drivers and those who work for small companies usually must clean their cabs. In large companies, this job may be done by other workers.

Places of Employment

In 1972, about 92,000 taxi drivers, including a small number of women, were employed full time in the taxicab industry. Many others worked part time. Although taxicab drivers are employed in all but the smallest cities, employment is concentrated in large metropolitan areas.

Training, Other Qualifications, and Advancement

To become a taxi driver in most cities, it is necessary to have a State-issued chauffeur's license and a special taxicab operator's license issued by the local police, safety department, or Public Utilities Commission. Although licensing requirements vary considerably among cities, in general, applicants must be over 21 years old and in good health, have a good driving record, and not have been convicted of a serious crime. A driver's record usually is checked for arrests, both locally and through the FBI.

Most large communities require an applicant for a taxi driver's license to pass a written examination on taxicab and traffice regulations. The examination may include questions on street locations, insurance regulations, accident reports, lost articles, and zoning or meter rules. In some cities, the cab company will teach the driver-applicant taxicab regulations and the location of streets and important buildings. In other cities, the driver must prepare himself for the examination.

Although formal education is seldom required, many companies prefer applicants to have at least an eighth-grade education. Drivers must be able to deal tactfully and courteously with all types of people.

Opportunities for advancement are limited by the small number of supervisory positions. Promotion to the job of dispatcher is often the only possibility. Some drivers, however, have become road supervisors, garage superintendents, or claims agents. A few develop administrative skills and advance to managerial positions in the company. To increase their income, many drivers try to buy and operate their own cabs.

Employment Outlook

The number of taxi drivers declined slowly during the last decade, and this trend is expected to continue through the mid-1980's. The decline in taxicab driver employment is expected to result from the increased use of private and rented cars. Competition from improved local bus and subway systems may contribute to the decline. However,

there will be many opportunities for new drivers, primarily because of the high turnover in this occupation. Because they work long hours and have irregular incomes, many taxi drivers leave to take jobs in other occupations. There will continue to be many part-time jobs available in nearly every community.

Earnings and Working Conditions

Most taxi drivers are paid a percentage—usually between 40 and 50 percent—of the total fare. Drivers also frequently receive tips, ranging from 10 to 20 percent of the fare. In 1972, one large company estimated its drivers averaged $3 an hour, not including tips. Some taxi drivers covered by union-employer contracts have guaranteed minimums up to $80 a week.

Many drivers rent their cabs from the company by the day for a set price. Any receipts above the cab rental and other operating expenses are retained by the drivers.

Many full-time drivers start work between 6 a.m. and 8 a.m. to be available for passengers going to work and quit after the evening rush of passengers returning home. During the day they may rest for several hours. Drivers do not receive overtime pay. Other drivers work nights, starting between 3 p.m. and 5 p.m. and some on Sundays and holidays. Full-time drivers receive fringe benefits such as paid holidays, vacations and sick pay.

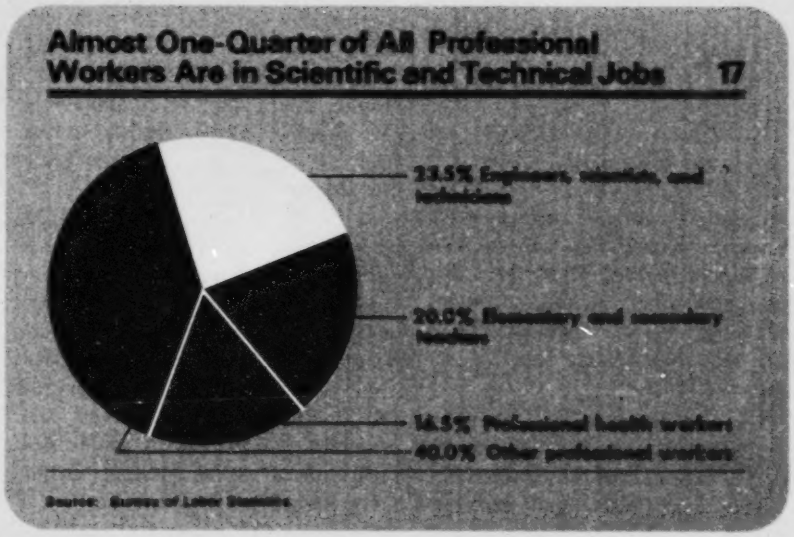
Sources of Additional Information

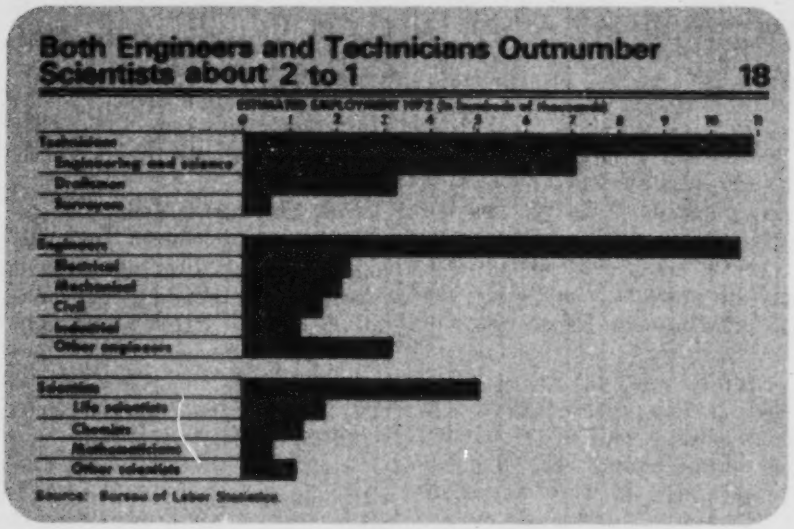
For further information on job opportunities in this field, contact local cab companies or the local office of the State employment service.

SCIENTIFIC AND TECHNICAL OCCUPATIONS

Progress in every facet of American life depends to some degree on our scientific and technical work force. An increased standard of living, greater defense capabilities, exploration of outer space, and advancement in atomic energy, health, and communications are just some of the results of the work done by scientists, engineers, and technicians.

About 2.7 million people or nearly one quarter of all professional workers were engineers, scientists, and technicians in 1972. (See charts 17 and 18.) Employment of scientists, engineers, and technicians increased much more rapidly than did total employment over the past two decades; the number of scientists and engineers, for example, almost tripled, while the total number of workers in the United States grew by slightly over one-third. The growth of our scientific and technical work force resulted from many factors, including overall economic growth, increased research and development (R&D) expenditures; growth of college and university faculties; the race to put a man on the moon; and the development of sophisticated defense systems. Many technological innovations, such as the widespread use of computers, also contributes to the growth.


Almost One-Quarter of All Professional Workers Are in Scientific and Technical Jobs 17
23.5% Engineers, scientists, and technicians
20.0% Elementary and secondary teachers
16.5% Professional health workers
40.0% Other professional workers
Source: Bureau of Labor Statistics



Engineers

Engineers play a prominent role in bringing scientific progress into our everyday lives. They convert raw materials and sources of power into products by applying basic scientific principles. Most engineers work in private industry—primarily industries manufacturing machinery, electrical equipment, and aircraft, and firms providing engineering and architectural services.

Engineers usually specialize in one of several branches. Electrical and mechanical engineering are the largest specialties. Many engineers further specialize within an indus-

try such as aerospace, or in a particular field of technology.

Engineers perform many functions in their work. They design, develop, and test equipment; sell technical products; and provide technical assistance to customers. Some supervisory and management jobs require a basic knowledge of engineering.

Scientists

Scientists help man acquire knowledge about himself and animal and vegetable life. They study the earth and other planets to better understand our environment and to help man obtain the earth's resources.

The largest group of natural scientists deal with the laws of the physical world; this group includes chemists, physicists, and environmental scientists. Chemists total more than half of all physical scientists. They usually work in private industry; almost half are in chemical manufacturing. A fifth of all physical scientists are physicists. Most work in colleges and universities, teaching or doing research and development or in private industry—mostly in companies manufacturing aerospace and defense related products.

Environmental scientists (geologists, geophysicists, meteorologists and oceanographers) are becoming more important as man realizes that the raw materials and sources of energy in the earth are limited. Most of the largest group, geologists and geophysicists, work in petroleum extraction industries or teach and do research in colleges and universities.

Life scientists study all living organisms and life processes from the largest animals to the smallest microbes. The majority teach or do research in colleges and universities. Biological scientists are the largest group of life scientists. Medical scientists have been the fastest growing of all the scientists over the past two decades.

Mathematicians, employed in every industry, have grown nearly as fast as medical scientists, and work in a wide variety of activities, ranging from the development of new theories to the translation of scientific and managerial problems into mathematical terms.

Scientists have a wide range of jobs. Many work in research, but the specific job varies. Entomologists, for example, experiment with ways to encourage production of honeybees. Physiologists study reproduction of plant and animal cells. Nutritionists discover the amounts and kinds of food elements essential to animals. Other scientists research inanimate matter. Chemists, for example, determine the chemical composition of substances, and physicists may experiment with lasers. Other opportunities in government and private industry include testing and inspecting, production oriented jobs, management and administration, and consulting.

Technicians

Technicians directly or indirectly support scientists and engineers in every phase of work, including the designing of equipment, the development of new products and processes, the production of goods, and the maintenance of machines and materials.

Nearly two-thirds assist engineers and scientists in research and development, and in production and quality control jobs in industry. One third of all technicians are draftsmen, and a small percent (58,000) are surveyors.

Engineering and science technician jobs are more practical and limited in scope than those of engineers and scientists. The more highly skilled jobs require the ability to analyze and solve engineering and science problems and to prepare reports on tests and experiments.

Technicians in research and development set up complex laboratory equipment and help design scientific instruments. In production, they may help test and inspect products or act as a liasion between engineering and production departments. Others sell technical products, install complex equipment, and provide technical services to customers.

Training

Training for scientific and technical work depends on the specific job. Scientists and engineers need at least a bachelor's degree for entry level jobs. However, increasing emphasis is being placed on advanced degrees, especially in mathematics, physics, and the life sciences. Some scientific occupations, such as astronomers and oceanographers, require a doctorate for full professional status. Most engineers can still enter their profession with only a bachelor's degree.

Undergraduate training for scientists and engineers includes courses in their field and related science fields, including mathematics. Courses in statistics and computer programming analysis are becoming more important. Liberal arts requirements include English and a foreign language.

In graduate school, students usually take several courses in their major area of study. Requirements

for the master's or doctor's degree vary by institution, but usually include a thesis based on independent research. Students who want to specialize in a particular occupation should select their schools carefully. For example, biomedical engineers and biochemists working in medicine should study at a university affiliated with a hospital. Agricultural scientists can get the most practical training at State universities that have agricultural experiment stations.

Technicians acquire training in many ways. Some complete on-the-job training programs, take formal courses part-time while gaining work experience, or obtain training in the Armed Forces. However, many employers seek graduates of specialized training programs. One to four year training programs are offered in post-secondary schools—technical institutes, technical vocational high schools, junior and community colleges, area vocational technical schools, and extension divisions of colleges and universities.

Outlook

Opportunities in scientific and technical occupations are expected to expand through the mid-1980's. Growth in opportunities assumes that additional numbers of engineers, scientists, and technicians will be needed to carry out research and development (R&D) work. In the past, growth in these occupations has been related to increased R&D expenditures, especially by the Federal Government. R&D expenditures of government and industry are expected to increase through the mid-1980's, although more slowly than during the 1960's. If actual R&D levels and patterns differ significantly from those assumed, the outlook in many occupations would be altered.

Despite expected growth in all scientific and technical occupations through the mid-1980's, employment and advancement opportunities will vary by occupation because of future supply. For example, very rapid growth in employment of mathematicians is anticipated between now and the mid-1980's. However, because of the sharp increase projected in the number of people graduating each year with degrees in mathematics, new entrants with the bachelor's degree may face competition for entry jobs.

Scientists, engineers, and technicians will be needed to develop new technologies and better products for a larger population and for competition in world markets. Many new interdisciplinary areas also will require technically-trained people to generate and transmit solar energy; solve air, water, and noise pollution problems; create a robot mining system; and control possible earthquakes.

The following sections of the handbook provide detailed information for 4 conservation occupations, 11 engineering specialties, 13 scientific occupations including life, physical, environmental and mathematical scientists, and 5 technician occupations.

CONSERVATION OCCUPATIONS

Forests, rangelands, wildlife, soil, and water are important natural resources. Conservationists protect, develop, and manage these resources to assure that future needs will be met.

A young person interested in a career in conservation must have specialized training or experience. Foresters, range managers, and soil conservationists generally need bachelor's degrees in their fields. Short-term or on-the-job training is usually required for positions such as forestry technicians and aides.

In addition to technical knowledge and skills, conservationists must have a sincere interest in the environment and the desire to protect it. They should enjoy dealing with others and like public service, since they often work with people in the community. Flexibility also is important, since a conservationist may work in a remote camping area one week, speak to a community group the next, and fight a forest or brush fire the next.

This section describes four conservation occupations—forester, forestry technician and aide range manager, and soil conservationist.

FORESTERS

(D.O.T. 040.081)

Nature of the Work

Forests are a vital resource. They can be used repeatedly without being destroyed—if properly managed. The condition of our environment has become a major national concern, and foresters play a great role in protecting that environment by insuring that our forests are properly used. They manage, develop, and protect these lands and their resources—timber, water, wildlife, forage, and recreational areas.

Foresters estimate the amount and value of forest resources. They plan and supervise the cutting and planting of trees; the sale of trees and timber; and the processing, marketing, and use of forest products. Foresters also determine the location and type of recreation that can be allowed in the forest. They protect the forests and their resources from fire, harmful animals and insects, and diseases. Other duties include wildlife protection, erosion control, and the supervision of camps, parks, and grazing lands.

Foresters also do research, provide forestry information to forest owners and to the general public (called extension work), and teach at colleges and universities.

Foresters usually specialize in one area of work, such as timber management, outdoor recreation, or forest economics. Some of these areas are recognized as distinct professions.

Places of Employment

About 22,000 persons—most of them men—worked as foresters in 1972. One-third worked in private industry, mainly for pulp and paper, lumber, logging, and milling companies. About one-fourth worked for the Federal Government, primarily in the Forest Service of the Department of Agriculture, although some worked for the Departments of Interior and Defense. The remainder worked for State and local governments, colleges and universities, consulting firms, or were self-employed, either as consultants or forest owners.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in forestry is the minimum educational requirement for those desiring professional careers in forestry. An advanced degree is usually required for teaching and research positions.

Education in forestry leading to a bachelor's or higher degree was offered in 1972 by 51 colleges and universities, of which 39 were accredited by the Society of American Foresters. Curriculums stress the liberal arts as well as technical forestry subjects, since communications skills and the appreciation of American culture are important

to the forester. Specialized forestry courses range from forest ecology (structure of, and interrelationships in the forest community) to forest administration. Many colleges require students to spend one summer in a field camp operated by the college and encourage summer jobs that give firsthand experience in forest or conservation work.

Forestry graduates often work under the supervision of experienced foresters before advancing to more responsible positions in forest management or research.

Foresters must have enthusiasm for outdoor work, and be physically hardy and willing to work in remote areas. Forestry work makes both intellectual and physical demands.

Employment Outlook

Requirements for foresters are expected to increase moderately through the mid-1980's. However, the number of new graduates with degrees in forestry could exceed job openings if current trends in forestry education continue, resulting in keen job competition.

The demand for foresters is expected to rise as the country's growing population and rising living standards increase the demand for forest products and the use of forests for recreational purposes. Employment also may increase as we become more aware of the need to conserve and replenish our forest resources, and to improve environmental quality.

Private owners of timberland are expected to employ more foresters as they recognize the need for and the higher profitability of improved forestry and logging practices. The forest products industries also will require additional foresters to apply new techniques for using the entire forest crop, to develop methods of growing superior trees in a shorter period of time, and to do research in the fields of plant genetics and fertilization.

Employment opportunities for foresters in the Federal Government probably will not increase significantly because of the changing nature of the forester's duties. Specialized scientists—hydrologists, landscape architects, civil engineers, etc.—will increasingly perform the more scientific work formerly done by the forester. Aides and technicians increasingly may perform some of the routine tasks previously done by foresters, who will be more concerned with the overall administration and coordination of work done by specialists and aides.

On the other hand, State Government agencies will probably continue to hire foresters. Forest fire control, insect and disease protection, technical assistance to owners of forest lands and other Federal-State cooperative programs are usually channeled through State forestry organizations. Growing demand for recreation in forest lands may result in the expansion of State parks and other recreational areas.

College teaching and research in areas such as forest genetics and forest disease also may provide employment opportunities for foresters with graduate degrees.

Earnings and Working Conditions

Foresters earn high salaries compared to the average for nonsupervisory workers in private industry, except farming. In the Federal Government in early 1973, beginning foresters with a bachelor's degree could start at either $7,694 or $9,520 a year, depending on their academic record. Those having 1 or 2 years of graduate work could begin at $9,520 or $11,614, persons having the Ph.D. could start at either $13,996 or $16,682 a year. District rangers employed by the Federal Government in 1972 generally earned between $11,614 and $16,682 a year. Foresters in top level positions earned considerably more.

Beginning salaries of foresters employed by State governments vary widely, but, with a few exceptions, tend to be lower than Federal salaries. Entrance salaries in private industry, according to limited data, are comparable to Federal salary levels.

Forestry teachers are paid the same as other faculty members. (See statement on College and University Teachers.) Forestry professors may add to their regular salaries with income from part-time consulting and lecturing and the writing of books and articles.

The forester—especially in beginning jobs—spends considerable time outdoors in all kinds of weather. Foresters may also work extra hours on emergency duty, such as fire-fighting.

Sources of Additional Information

General information about the forestry profession, lists of reading materials and lists of schools offering education in forestry are available from:

Society of American Foresters, 1010 16th St. NW., Washington, D.C. 20036.

General information is also available from:

American Forest Institute, 1619 Massachusettes Ave. NW., Washington, D.C. 20036.

American Forestry Association, 1319 18th St. NW., Washington, D.C. 20036.

Information on forestry careers

in the Forest Service is available from:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

FORESTRY AIDES AND TECHNICIANS

(D.O.T. 441.137 through 441.887)

Nature of the Work

Forestry aides, and technicians at higher career levels, help foresters care for and manage forest lands and their resources. (See statement on Foresters earlier in this chapter.)

Aides help estimate present and potential timber production in a certain area and measure logs to find out how much lumber they will yield. If new roads are needed to make the timber accessible for cutting, aides may work as part of road building or surveying crews.

Aides inspect trees for diseases and other problems, and keep records of their findings. On simple watershed improvement projects, they install, maintain, and collect records from rain gauges, streamflow recorders, and instruments that measure soil moisture.

Forestry aides also help to prevent and control fires. They give fire prevention information to people using the forest and lead fire-fighting crews if a fire occurs. After putting out the fire, they take inventory of burned areas and plant new trees and shrubs to restore the forest.

Some forestry technicians supervise timber sales and road building crews or determine recreation-area use. Others work on research projects which make use of their practical skills and experience.

Forestry aides inspect trees for diseases and other problems.

Technicians also explain forest regulations and policies to those using the forest and enforce these rules.

Places of Employment

About 14,500 persons worked as forestry aides and technicians in 1972. Some of these were seasonal employees. Almost half the total worked for the Federal Government, primarily in the Forest Service of the U.S. Department of Agriculture. Another 2,300 worked for State Governments. About 5,000 worked in private industry, mainly for logging, lumber, and paper companies. Forestry aides also work in tree nurseries and on forestation projects of mining, oil, and railroad companies.

Training, Other Qualifications, and Advancement

Young persons qualify for beginning jobs as forestry aides or technicians by completing a specialized 1- or 2-year post secondary school, or through work experience or a government sponsored training program. In 1972, about 90 technical institutes, junior or community colleges, and universities offered forest technician training, of which 46 are recognized by the Society of American Foresters.

Specialized courses include land surveying, tree identifications, and aerial photograph interpretation. To gain experience, students may spend time working in a forest or camp operated by the school.

Young people also may qualify for beginning forestry aide jobs by completing programs sponsored under the Manpower Development and Training Act. These programs are presently available in 20 states, over half of the trainees work in Washington, Colorado, and Florida.

Persons who have not had specific training usually must have experience in forest work, such as planting trees or fighting fires, to qualify for beginning forestry aide jobs. The Federal Government requires that applicants for technician jobs have 2 years of related work experience, such as in agriculture, although technical training in forestry may be substituted for this experience.

Enthusiasm for outdoor work, physical stamina, and the ability to carry out tasks without direct supervision are essential for success in this field. The aide should be able to work with survey crews, users of the forest lands, forest owners, and professional foresters. Many jobs also require a willingness to live and work in remote areas.

Well trained technicians need to understand the basic principles of math and science. They must express their ideas clearly when talking to others. Besides having specialized knowledge of their own

work, they should be aware of the other materials and techniques used in forestry.

Forest technicians generally begin work as trainees or in relatively routine positions under the direct supervision of an experienced technician, scientist, or professional forester. As they gain experience, they are given more responsibility, and often move into supervisory positions.

Employment Outlook

Employment opportunities for forestry aides are expected to increase very rapidly through the mid-1980's. Job opportunities will be especially good for those with specialized post-high school technical training in forestry.

As the employment of foresters continues to grow, increasing numbers of forestry aides and technicians will be needed to assist them. In addition, aides and technicians increasingly will perform many of the more routine jobs now being done by foresters. Another important factor leading to increased demand for forest technicians is the technological growth in the forest industry. Trained technicians will be required to help professional foresters use specialized and efficient laborsaving machines and to apply sophisticated scientific development methods to forest management.

The Federal Government is also likely to offer increasing employment opportunities through the mid-1980's, mainly in the Forest Service of the Department of Agriculture. Similarly, State governments will probably increase their employment of forestry aides. Growth in government employment will stem from factors such as increasing demand for recreational areas and the trend toward more scientific management of forest land and water supplies.

Earnings and Working Conditions

Annual earnings of forestry aides and technicians range from about $5,000 to almost $16,000; those having high earnings usually have had many years of experience. Forestry aides have average salaries that are higher than the average for all nonsupervisory workers in private industry, except farming. In the Federal Government, beginning forestry aides and technicians earned between $5,432 and $7,694 a year in early 1973, depending on the applicant's education and experience. Beginning salaries in private industry were slightly higher, according to the limited data available.

Forestry aides spend considerable time outdoors in all weather conditions. In emergencies, such as fighting fires and controlling floods, forestry aides work many extra hours. Climate conditions in some areas limit year-round field work, and some jobs, such as firefighting, are seasonal in nature.

Sources of Additional Information

Information about a career in the Federal Government as a forestry aide is available from:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

For a list of schools recognized by the Society of American Foresters offering training in the field write to:

Society of American Foresters, 1010 16th St. NW., Washington, D.C. 20036.

RANGE MANAGERS

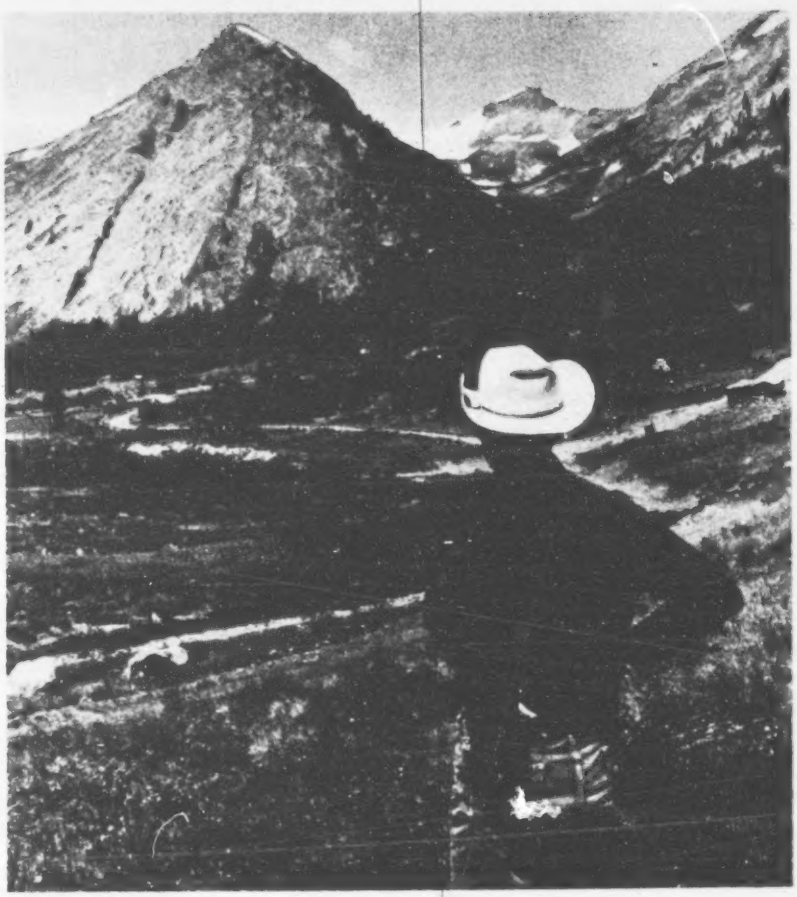
(D.O.T. 040.081)

Nature of Work

Rangelands cover more than 1 billion acres of the United States, mostly in the Western States and Alaska. They contain many natural resources: grass and shrubs for animal grazing, habitats for livestock and wildlife, facilities for water sports and other kinds of recreation, and areas for scientific study of the environment. These renewable resources can yield their full potential only if properly managed.

Range managers, sometimes called *range conservationists, range scientists,* or *range ecologists,* manage improve, and protect range resources. They decide, for example, the number and kind of animals to be grazed and the best season for grazing; and thus how to yield a high production of livestock while conserving soil and vegetation for other uses such as wildlife grazing, outdoor recreation, watersheds, and growing timber. Range managers also restore or improve rangelands through techniques such as controlled burning, reseeding, and the biological, chemical, or mechanical control of undesirable plants. For example, rangelands with natural sagebrush vegetation may be plowed up and reseeded with a more productive grass. They also determine and carry out range conservation and development needs such as providing for animal watering facilities, erosion control, and fire prevention.

Because of the multiple use of rangelands, range managers often work in such closely related fields as wildlife and watershed management, forest management, and recreation. They also may teach, write reports, conduct research in range



Range managers study terrain to decide the number and kinds of animals to be grazed.

management and improvement, and give technical assistance to holders of privately owned grazing lands and to foreign countries.

Places of Employment

About 4,000 persons—most of them men—worked as range managers in 1972. Additional numbers were employed in range management activities but not necessarily as range managers. The majority worked for Federal, State, and local government agencies. In the Federal Government, most worked in Forest Service and the Soil Conservation Service of the Department of Agriculture and the Bureau of Land Management of the Department of the Interior. Range managers in State governments are employed in game and fish departments, State land agencies, and extension services.

Some range managers work for privately-owned range livestock ranches and consulting firms, and some manage their own land. A few are self-employed consultants. Others work for manufacturing, sales, and service companies, and as rangeland appraisers for banks and real estate firms.

A few range managers also teach and do research at colleges and universities, or work overseas with United States or United Nations agencies or for foreign governments.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in range management or range conservation is the usual background for range managers. In the Federal Government, a degree in a closely related field, such as agronomy or forestry, including courses in range management and range conservation, also may be accepted. Graduate degrees are generally required for teaching and research, and may be helpful for advancement in most jobs.

In 1972, 14 colleges and universities had programs leading to a degree in range management or range science. Ten schools had programs in related fields such as forestry, botany, or agronomy, with an option in range management. Fourteen schools offered a masters degree in range management or range science, and 12 schools offered a Ph.D degree in range science or a related field with a range major.

A degree in range management requires a basic knowledge of biology, chemistry, physics, mathematics, and communication skills. Advanced courses combine plant, animal, and soil sciences with principles of ecology and resource management. Desirable electives include economics, computer science, forestry, wildlife, and recreation.

Federal Government agencies, primarily the Forest Service, the Soil Conservation Service, and the Bureau of Land Management, hire some college juniors and seniors for summer jobs in range management. This experience may help them qualify for jobs when they graduate.

Many jobs require vigorous physical activity and a willingness

to work in arid and sparsely populated areas. Besides having a love for the outdoors, range managers should be able to write and speak effectively and work with others.

Employment Outlook

Employment opportunities for range managers are expected to increase slowly through the mid 1980's. Public concern about the environment, however, could lead to greater opportunities for all types of conservationists, including range managers. Actual hiring needs, though, are heavily dependent on specialized legislation. In the Federal Government, for example, the Wild Horse and Burro Act passed in December 1971 create requirements for range managers to administer the program for protection, control, and management of these animals.

Population growth and increas ing consumption of meat and other rangeland animal products should contribute to increasing requirements for range managers. Since the amount of rangeland is generally fixed, range managers will be needed to increase the output of rangelands while protecting their ecological balance. Also, the use of rangelands for other purposes besides livestock grazing such as wildlife protection and recreation could create additional needs for range managers.

If private ranch owners decide to live away from their ranches, these absentee owners may hire professional range managers to operate their ranches. A few openings for technical assistants are expected in developing countries of the Middle East, Africa, and South America.

In addition to new jobs, some openings will arise from the need to replace those who die, retire, or transfer to other occupations.

Earnings and Working Conditions

Range managers have high earnings compared with average earnings for a nonsupervisory workers in private industry, except farming.

In the Federal Government, range managers with the bachelor's degree start at either $7,694 or $9,520 a year, depending on their college grades. Those having 1 or 2 years of graduate work begin at $9,520 or $11,614; persons with Ph.D. degrees start at either $13,996 or $16,682 a year.

Starting salaries for range managers who work for State governments are about the same as those paid by the Federal Government. According to limited data, those who work on private ranches earn somewhat lower salaries than persons who work for government agencies. In colleges and universities, starting salaries are generally the same as those paid other faculty members. (See statement on College and University Teachers.) Range managers in educational institutions sometimes add to their regular salaries with income from part-time consulting and lecturing and from writing books and articles.

Range managers may spend considerable time away from home working outdoors in remote parts of the range.

Sources of Additional Information

Information about a career as a range manager as well as a list of schools offering training is available from:

Society for Range Management, 2120 South Birch St., Denver, Colo. 80222.

For information about career opportunities in the Federal Government, contact:

Bureau of Land Management, Denver Service Center, Federal Center Building 50, Denver, Col. 80255.

or

Portland Service Center, 710 N E. Holladay St., Portland, Oreg. 97208.

Forest Service, U.S. Department of Agriculture, 1621 North Kent Street Arlington, Va. 20415.

Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250.

SOIL CONSERVATIONISTS

(D.O.T. 040.081)

Nature of the Work

Soil conservationists supply farmers, ranchers, and others with technical assistance for conservation of soil and water. Farmers and other land managers use this technical assistance in adjusting land use, protecting land against future soil deterioration, rebuilding eroded and depleted soils, and stabilizing runoff and sediment-producing areas. They also help improve cover on lands devoted to raising crops, and maintaining forest, pasture, and range land, and the wildlife they support. They help plan water handling, conserving water for farm and ranch use, reducing damage from flood water and sediment, and draining or irrigating farms or ranches as needed.

The types of technical services provided by soil conservationists are many. Maps present inventories of soil, water, vegetation, and other details essential in conservation planning and application. They develop information, for proper land utilization and treatment suitable to planned use of the land, varying from field or partial farm or ranch through groups of farms or ranches to entire watersheds. Relative cost and expected returns help to determine various alternatives of land use and treatment.

Soil conservationists provide farmers with technical assistance.

After the landowner or operator decides upon the conservation program to use the conservationist records the relevant facts as part of a plan. This, together with the maps and other supplemental information, constitutes a plan of action for conservation farming or ranching. The soil conservationist then gives the land manager technical guidance in applying and maintaining these conservation practices.

Where Employed

An estimated 12,000 soil conservationists were employed in 1972. Most soil conservationists are employed by Federal Government, mainly by the U.S. Department of Agriculture's Soil Conservation Service and by the Department of the Interior's Bureau of Indian Affairs. Some are employed by colleges and State and local governments, and others by banks and public utilities.

Training and Advancement

A Bachelor of Science degree with a major in soil conservation or one of the closely related natural science or agricultural fields, with 30 semester hours in these fields including a 3-semester-hour course in soils, constitute the minimum requirement for soil conservationists. Those who have unusual aptitude in the various phases of the work have good chances of advancement to higher salaried technical administrative jobs.

Employment Outlook

Employment opportunities for well-trained soil conservationists are good. Opportunities in the profession will expand because government agencies, public utility companies, banks, and other organizations are becoming interested in conservation and are adding conservationists to their staffs. Other new openings will occur in college teaching, particularly at the undergraduate level. In addition, some openings will result because of the normal turnover in personnel.

Earnings

Soil conservationists having a bachelor's degree and employed by the Federal Government received $7,694 a year in early 1973. Advancement to $9,520 could be expected after 1 year of satisfactory service. Further advancement depends upon the individual's ability to accept greater responsibility. Earnings of well-qualified Federal soil conservationists with several years' experience range from $13,996 to $23,088 a year.

Sources of Additional Information

Additional information on employment as a soil conservationist may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; Employment Division, Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

ENGINEERS

"One small step for man, one giant leap for mankind," were man's first words as he stepped on the surface of the moon. Exploring the moon had been an idea or dream for centuries, and this is one example of what engineering is about, changing ideas into reality. The emphasis on applying scientific principles, rather than on their discovery, is a main factor that distinguishes engineers from scientists.

With over 1 million members engineering is the second largest professional occupation, exceeded only by teachers. For men it is the largest profession. Most engineers specialize in one of the many branches of the profession. More than 25 engineering specialties are recognized by professional societies. Besides the major branches, engineering has over 85 subdivisions. Structural, sanitary, hydraulic, and highway engineering, for example, are subdivisions of civil engineering. Engineers may also specialize in the engineering problems of one industry, or in particular fields of technology such as propulsion or guidance systems. Since basic knowledge is required for all areas of engineering, it is possible for engineers to shift from one field of specialization to another, particularly early in their careers. Besides these common areas of basic knowledge and methods, inter-disciplinary programs both within engineering science and other specialities are increasing in popularity. Therefore, persons considering engineering as a career should become familiar with the general nature of engineering as well as with its various branches.

This section which contains an overall discussion of engineering, is followed by separate statements on 11 branches of the profession—aerospace, agricultural, biomedical, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, and mining engineering.

Nature of the Work

Engineers contribute in countless ways to the welfare, technological progress and defense of the Nation by developing methods for making natures raw materials and power sources into useful products at a reasonable cost. They develop electric power, water supply, and waste disposal systems to meet the problems of urban living. They design industrial machinery and equipment needed to manufacture goods; and heating, air-conditioning, and ventilation equipment for more comfortable living. Engineers also develop scientific equipment to probe outer space and the ocean depths, and design, plan, and supervise the construction of buildings, highways and rapid transit systems. They also, design and develop consumer products such as automobiles, television sets, and refrigerators, and systems for control and automation of manufacturing, business, and management process.

Engineers must consider many factors in developing a new product. In designing a space capsule, for example, they calculate the amount of heat, radiation, and pressure the capsule must withstand for the safety of the occupants and the proper working of its instruments. Experiments are conducted that relate these factors to various materials, as well as to many capsule sizes, shapes, and weights. Equally important are the human needs and limitations of the people who operate the equipment. Engineers also consider the cost of the materials and time needed to complete the product. Similar factors are applicable to most products ranging from artificial hearts to electronic computers and industrial machinery.

In addition to design and development, engineers work in inspection, quality control, and many other activities related to manufacturing, mining, and agriculture. Some are in administrative and management jobs where an engineering background is necessary. Many are employed in sales where they must discuss the technical aspects of a product and assist in planning its installation or use. (See statement on Manufacturers' Salesmen elsewhere in the Handbook). Some conduct research to supply the technological data needed for the design and production of new or improved products. Other engineers with considerable experience work as consultants. Another group, especially at the Ph.D. level, teach in the engineering and technical schools of colleges and universities.

Engineers within each of the branches may apply their specialized knowledge to many fields. Electrical engineers, for example, may work in medicine, computers, missile guidance, or electric power distribution. Because engineering problems are usually complex, the work in some fields cuts across the traditional branches. Using a team approach to solve problems, engineers in one field often work closely with

specialists in other scientific, engineering, and business occupations.

Places of Employment

About 1 million people worked as engineers in 1972, about 1 percent were women. More than half work in manufacturing—mostly in electrical equipment, aircraft and parts, machinery, chemicals, ordnance, instruments, primary metals, fabricated metal products, and motor vehicles industries. Over 325,000 were employed in nonmanufacturing industries in 1972, primarily construction, public utilities, engineering and architectural services, and business and management consulting services.

Federal, State, and local governments employed more than 150,000 engineers. Over half worked for the Federal Government. Many engineers were employed by the Departments of Defense, Interior, Agriculture, Transportation, and the National Aeronautics and Space Administration. Most engineers in State and local government agencies worked in highway and public works departments.

Colleges and universities employed almost 45,000 engineers in research and teaching jobs, and a small number worked for nonprofit research organizations.

Engineers are employed in every State, in small and large cities and in rural areas. However, about two-thirds of all engineers in private industry are employed in 10 States, and of these almost one-third are in California, New York, and Pennsylvania. Some branches of engineering are concentrated in particular industries, as shown in the statements later in this chapter.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is the generally accepted educational requirement for beginning engineering jobs. College graduates trained in one of the natural sciences or mathematics also may qualify for some beginning jobs. Technicians with exceptional ability, experience, and some engineering education are sometimes able to advance to engineering jobs.

Graduate training is being emphasized for an increasing number of jobs; it is essential for most beginning teaching and research positions, and desirable for advancement. Some specialties, such as nuclear engineering, generally are taught only at the graduate level.

About 280 colleges, universities, and engineering schools offer a bachelor's degree in engineering. Although most schools offer the larger branches of engineering, some specialties are taught in very few institutions. Students desiring specialized training should be familiar with various curriculums before selecting a college. Undergraduate engineering schools require high school courses in mathematics and the physical sciences and the quality of the student's high school work is important in gaining admission.

In a typical 4-year curriculum, the first 2 years are spent on basic science—mathematics, physics, and chemistry—and the humanities, social sciences, and English. The last 2 years are devoted to engineering with emphasis on a specialty. Some programs offer a general engineering education and the student chooses a specialty in graduate school or acquires one on the job.

Some engineering curriculums require more than 4 years to complete. Although, the number of colleges and universities having 5-year programs that lead to the bachelor's degree is decreasing, several now offer 5 year master's degree programs. In addition, several engineering schools now have formal arrangements with liberal arts colleges whereby a student spends 3 years in liberal arts and 2 years in engineering and receives a bachelor's degree from each. These programs offer students diversification in their studies.

Some schools have 5- or even 6-year cooperative plans where the student alternates between school and work. Most plans coordinate classroom study and practical experience. In addition to gaining experience students may finance part of their education.

All 50 States and the District of Columbia require licensing for engineers whose work may affect life, health, or property, or who offer their services to the public. In 1972, about 325,000 engineers were registered under these laws. Generally, registration requirements include graduation from an accredited engineering school plus 4 years of experience and passing a State examination.

Engineers should be able to work as part of a team, be creative, have initiative, an analytical mind, a capacity for detail, and the ability to make decisions. They should be able to express their ideas to specialists in other areas such as marketing and production planning. Because of rapidly changing technologies, engineers must be willing to continue their education throughout their career.

Engineering graduates usually begin work as assistants to experienced engineers. Many companies have special programs to acquaint new engineers with special industrial practices and to determine the specialties for which they are best suited. Experienced engineers may advance to positions of greater responsibility; those with proven

ability often become administrators; increasingly large numbers are being promoted to top executive jobs. Some engineers obtain graduate degrees in business administration to improve their advancement opportunities; others obtain law degrees and become patent attorneys.

Employment Outlook

Employment opportunities for engineers are expected to be favorable through the mid-1980's. Engineering has been one of the fastest-growing occupations over the past two decades, and opportunities for engineers are expected to increase very rapidly through the mid-1980's though at a slower rate than during the past. Demand probably will be strong for new graduates with knowledge of recent techniques, including computer applications, and for engineers who can apply engineering principles to medical, biological, and other sciences.

Opportunities for engineers are related to population growth and industrial expansion to meet the demand for more goods and services. In addition, more engineering time is required to develop complex industrial products and processes and to increase industrial automation. Public emphasis on solving domestic problems such as environmental pollution, urban redevelopment, and new sources of power should also create additional job opportunities.

Some of the past increases in engineering employment resulted from increases in Federal research and development (R&D) expenditures for space- and defense-related programs. Through the mid-1980's R&D expenditures of Government and industry are expected to continue to increase, but at a slower rate than during the 1960's. The slowdown in Federal R&D spending in the late 1960's and early 1970's basically reflects reductions in the relative importance of the space and defense components of R&D expenditures.

Opportunities for engineers are also affected by defense spending, since a large number of engineers work in defense related activities. The long range outlook for engineers assumes that defense spending in the mid 1980's will be somewhat lower than the peak Vietnam levels. If defense activity should differ substantially from that level, the demand for engineers will be affected.

In addition to the level of defense spending, general business conditions, shifting National priorities, and non-defense-related Federal programs and policies also influence the demand for engineers. Thus, opportunities for engineers fluctuate periodically. In the short-run, the available engineering jobs can either exceed or fall short of the number of persons looking for jobs, but over the long run, engineers can look forward to favorable job opportunities.

Besides filling new jobs, thousands of engineers will have to be trained to replace those who transfer to other occupations, retire, or die. (The outlook for various branches are discussed in the separate statements later in this section.)

Earnings and Working Conditions

New engineering graduates with a bachelor's degree and no experience had average starting salaries of $10,700 a year in private industry in 1972 according to the College Placement Council. Master's degree graduates with no experience averaged almost $12,300 a year; Ph.D. graduates averaged about $16,400. Starting salaries for those with the bachelor's degree vary by branch as shown in accompanying table.

Starting salaries for engineers, by branch, 1971–72

Branch	Average starting salaries
Aeronautical engineering ..	$10,600
Chemical engineering	11,100
Civil engineering	10,400
Electrical engineering	10,700
Industrial engineering	10,500
Mechanical engineering ...	10,700
Metallurgical engineering ..	10,600

In the Federal Government in early 1973, engineers with a bachelor's degree and no experience could start at $7,694 or $9,520 a year, depending on their college records. Beginning engineers with a bachelor's degree and 1 or 2 years of graduate work could start at $9,520 or $11,614. Those having a Ph.D. degree could begin at $13,996 or $16,682.

In colleges and universities, engineers with a Ph.D. degree started in 1972 at about $12,500 a year as assistant professors for a 9-10 month academic year. (See statement on College and University Teachers elsewhere in the *Handbook*.)

Most engineers can expect an increase in earnings as they gain experience. Average salaries of experienced engineers are about twice those of nonsupervisory workers in private industry, except farming.

According to an Engineering Manpower Commission Survey, the average salary for engineers with 21 to 23 years of experience was $19,600 in 1972. Some in top-level executive positions had much higher earnings.

Engineers generally work under quiet conditions in modern offices and research laboratories. Some, however, may be involved in more active work—in a mine, at a con-

struction or missile site, or some other outdoor location.

Sources of Additional Information

General information on engineering careers—including student selection and guidance, professional training, salaries, and other economic aspects of engineering—is available from:

Engineers' Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

Engineering Manpower Commission, Engineers Joint Council, 345 East 47th St., New York, N.Y. 10017.

National Society of Professional Engineers, 2029 K St. NW., Washington, D.C. 20006.

Information on engineering schools, curriculums, training, and other qualifications needed for entrance into the profession also may be obtained from the Engineers Council for Professional Development. Information on registration of engineers may be obtained from:

National Council of Engineering Examiners, P.O. Box 752, Clemson, S.C. 29613.

For information about graduate study contact:

The American Society of Engineering Education, One Dupont Circle, Suite 400, Washington, D.C. 20036.

Engineering societies representing the individual branches of the engineering profession are listed later in this chapter. Each can provide information about careers in the particular branch. Many other engineering organizations are listed in the following publications available in most libraries or from the publisher.

Engineering Societies Directory, published by Engineers Joint Council, 345 East 47th St., New York, N.Y. 10017.

Scientific and Technical Societies of the United States and Canada, published by the National Academy of Sciences, National Research Council.

Some engineers are members of labor unions. Information on engineering unions is available from:

International Federation of Professional and Technical Engineers, 1126 16th St. NW., Washington, D.C. 20036.

AEROSPACE ENGINEERS

(D.O.T. 002.081)

Nature of the Work

Aerospace engineers play a vital role in America's space activities. They work on all types of aircraft and spacecraft including missiles, rockets, and propeller-driven and jet-powered planes. They develop aerospace products from the initial planning and design to the final assembly and testing.

Aerospace engineers generally specialize in an area of work like structural design, navigational guidance and control, instrumentation and communication, or production methods. They also may specialize in one type of aerospace products such as passenger planes, launch vehicles, satellites, manned space capsules, or landing modules.

Engineers working in the aircraft field are usually called aeronautical engineers. Those in the field of missiles, rockets, and spacecraft often are referred to as astronautical engineers. However, engineers with degrees in aeronautics and astronautics are usually called aerospace engineers.

Places of Employment

About 60,000 aerospace engineers—many with degrees in mechanical, electrical or industrial engineering—were employed in 1972, mainly in the aircraft and parts industry. Some worked for Federal Government agencies, primarily the National Aeronautics and Space Administration and the Department of Defense. A few worked for commercial airlines, consulting firms, and colleges and universities.

Employment Outlook

Job opportunities for aerospace engineers are expected to grow moderately through the mid-1980's. Development of vertical and short take-off and landing (V/STOL) aircraft and the quiet short-haul air transportation system (QSATS), as well as the space shuttle, should provide job opportunities. Research with lasers and advancement in missiles and space exploration followed by unmanned flights to other planets will require aerospace engineers. As the demand for high speed ground transportation increases, engineers familiar with aerospace techniques could be needed for their development.

With the end of the Vietnam conflict and priorities now aimed at health and environmental control, and the encouragement of industry to expand the peaceful uses of atomic energy, aerospace engineers with diversified training such as bioengineering and radiation protection will be needed. Additional openings for aerospace engineers will arise from the need to replace those who transfer to other fields of work, retire, or die.

Aerospace engineers are particularly sensitive to changes in defense spending. Those who are not well grounded in engineering fundamentals and whose specialization is very narrow could be affected adversely by changes in defense activities and rapidly changing technology. Therefore employment opportunities fluctuate, and the demand can fall short of the supply in any year. Employment oppor-

tunities however, are expected to increase over the long run. This outlook assumes that defense spending will be somewhat lower than the peak Vietnam levels. If defense activities should differ substantially from that level, the demand for aerospace engineers will be affected. (See introductory section of this chapter for discussion of training requirements and earnings. See also statement on Aircraft, Missile, and Spacecraft Manufacturing elsewhere in the *Handbook*.)

Sources of Additional Information

American Institute of Aeronautics and Astronautics, Inc., 1290 Avenue of the Americas, New York, N.Y. 10019.

AGRICULTURAL ENGINEERS

(D.O.T. 013.081)

Nature of the Work

Agricultural engineers develop machinery, equipment, and methods to improve the efficiency and economy of the production, processing, and distribution of food and other agricultural products. They design farm machinery, equipment, and structures, and develop methods for utilizing electrical energy on farms and in food and feed processing plants. Agricultural engineers also are concerned with the conservation and management of soil and water resources, and with the design and operation of processing equipment to prepare agricultural products for market. They generally specialize in research and development, design, testing, production, sales, or management.

Places of Employment

Most of the 12,000 agricultural engineers employed in 1972 worked for manufacturers of farm and household equipment, electric service companies, and distributors of farm equipment and supplies. Some worked for engineering consultants who supply services to farmers and farm related industries; others are independent consultants.

The Federal Government employs about 600 agricultural engineers in the Soil Conservation Service and Agricultural Research Service of the Department of Agriculture. Some are employed by colleges and universities, and a few are employed by State and local governments.

Employment Outlook

Job opportunities for agricultural engineers are expected to grow rapidly through the mid-1980's. The modernization of farm operations, increasing emphasis on conservation of resources, and the use of agricultural products and wastes as industrial raw materials should provide increasing opportunities for agricultural engineers. The increasing use of energy and power on farms also should provide opportunities for additional engineers. (See introductory part of this section for information on training requirements and earnings. See also statement on Agriculture elsewhere in the *Handbook*.)

Sources of Additional Information

American Society of Agricultural Engineers, 2950 Niles Rd., St. Joseph, Mich. 49085.

BIOMEDICAL ENGINEERS

Nature of the Work

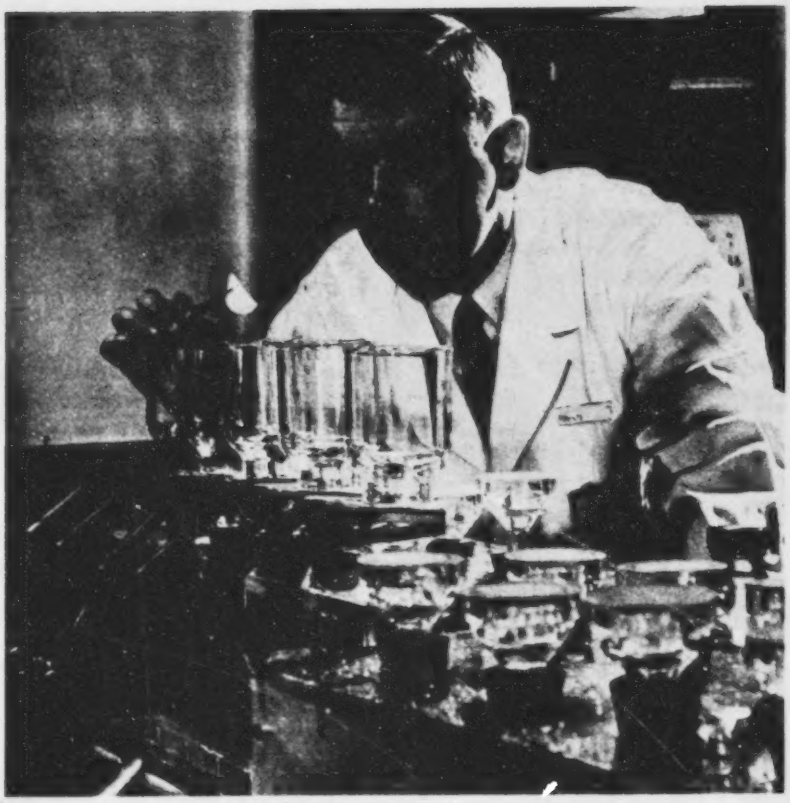
Biomedical engineers use engineering principles to solve medical and health related problems. Many in research, working with life scientists, chemists, and members of the medical profession study the engineering aspects of the biological systems of man and animals. Some design and develop medical instruments and devices including artificial hearts and kidneys. Biomedical engineers have helped develop lasers for surgery and cardiac pacemakers that regulate the heartbeat. Other biomedical engineers adapt computers to medical science by monitoring patients and processing electrocardiograph data. Some design and build systems to modernize laboratory, hospital and clinical procedures. A few sell medical instruments and equipment to physicians, research centers, and hospitals.

Places of Employment

There were 3,000 biomedical engineers in 1972; most members of this branch of engineering teach and do research in colleges and universities. Some work for the Federal Government, primarily in the National Aeronautics and Space Administration. Others work in State agencies, and an increasing number work in private industry or hospitals, developing new devices, techniques, and systems for improving health care. Some work in sales positions.

Employment Outlook

Job opportunities for biomedical engineers are expected to be very favorable through the mid-1980's. Biomedical engineering is a small field and has few openings in a year compared with larger branches



Most biomedical engineers do research.

of engineering, but the number of graduates is small.

Those who have master's and doctor's degrees will be in strong demand to teach and fill jobs resulting from increased expenditures for research and to develop more artificial devices. Research could create new positions in instrumentation and systems for the delivery of health services. (See introductory part of this chapter for information on training requirements and earnings.)

Sources of Additional Information

Alliance for Engineering in Medicine and Biology, 3900 Wisconsin Ave. NW., Suite 300, Washington, D.C. 20016.

Biomedical Engineering Society P.O. Box 1600, Evanston, Ill. 60204.

Foundation for Medical Technology Mt. Sinai Medical Center, 100 Street, 5th Ave., New York, N.Y. 10029.

CERAMIC ENGINEERS

(D.O.T. 006.081)

Nature of the Work

Ceramic engineers work with one of the world's oldest and yet newest technologies. They develop methods for processing clay and other nonmetallic minerals into a wide variety of ceramic products. These range from glassware, cement, bricks, coatings, and heat resisting materials for missile nose cones to electronic components and materials used as body sensors and monitors. They also design and supervise the construction of plants and equipment to manufacture these products. Many are engaged in research and development. Some work in administration, production, and sales; others work as consultants or teach in colleges and universities.

Ceramic engineers generally specialize in one or more products—for example, products of refractories (fire-and heat-resistant materials such as firebrick); whitewares (porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick tile, and terra cotta); electronic ceramics (ferrites for memory systems and microwave devices); protective and refractory coatings for metals; glass; abrasives; or fuel elements for atomic energy.

Places of Employment

About 12,000 ceramic engineers were employed in 1972, mostly in the stone, clay, and glass industries. Others work in industries that produce or use ceramic products such as iron and steel, electrical equipment, aerospace, and chemicals. Some are in the educational field, independent research organizations, and the Federal Government.

Employment Outlook

Job opportunities for ceramic engineers are expected to be very good through the mid-1980's. Although ceramic engineering is a small field, and has few openings in a year compared with large branches of engineering, the number of graduates is small.

Programs related to nuclear energy, electronics, space exploration, and medical science will provide many opportunities for ceramic engineers. Ceramic materials, which are corrosion-resistant and able to withstand radiation and extremely high temperatures, are becoming increasingly important in the development of nuclear reactors and space vehicles. The use of more traditional ceramic products, such as whitewares and abrasives, for consumer and industrial use will require additional ceramic engineers to improve and adapt these products to new uses. The use of structural clay and tile products in construction also will add to employment opportunities. The development of filters and catalytic surfaces to reduce pollution and the expanding use of glass in the construction and container fields should create additional openings for ceramic engineers. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

American Ceramic Society, 65 Ceramic Dr., Columbus, Ohio 43214.

CHEMICAL ENGINEERS

(D.O.T. 008.081)

Nature of the Work

Chemical engineers design chemical plants and equipment, and determine the most efficient process to manufacture chemicals and chemical products. This requires a knowledge of chemistry, physics, and mechanical and electrical engineering. They often design and operate pilot plants to test their work.

This branch of engineering is so diversified and complex that chemical engineers frequently specialize in a particular operation such as oxidation or polymerization. Others specialize in a particular area such as environmental control or in the production of a specific product like plastics or rubber. Chemical engineers may work in research and development, production, plant operations, design, sales, management or teaching.

Places of Employment

Most of the 50,000 chemical engineers working in 1972 were in manufacturing industries, primarily those producing chemicals, petroleum, and related products. Some were employed by government agencies and by colleges and universities. A small number worked for independent research institutes and engineering consulting firms, or as independent consulting engineers.

Employment Outlook

Opportunities for chemical engineers are expected to increase moderately through the mid-1980's. A major factor underlying this growth is industry expansion—the chemicals industry in particular.

The growing complexity and automation of chemical processes will require additional chemical engineers to design, build, and maintain the necessary plants and equipment. Chemical engineers also will be needed in many new areas of work, such as environmental control, synthetic food processing, and in the design and development of nuclear reactors. In addition, new chemicals used to manufacture consumer goods, such as plastics and manmade fibers, probably will create additional openings. (See introductory part of this section for information on training requirements and earnings. See also the statement on Chemists and the Industrial Chemical Industry elsewhere in the *Handbook*.)

Sources of Additional Information

American Institute of Chemical Engineers, 345 East 47th St., New York, N.Y. 10017.

CIVIL ENGINEERS

(D.O.T. 005.081)

Nature of the Work

Civil engineering is one of the oldest branches of the profession. These engineers design and supervise the construction of roads, harbors, airfields, tunnels, bridges, water supply and sewage systems, and buildings. Major specialties within civil engineering are structural, hydraulic, environmental, sanitary, transportation (including highways and railways), and soil mechanics.

Many civil engineers are in supervisory or administrative positions ranging from site supervisor of a construction project or city engineer to top-level executive. Some are engaged in design, planning, research, and inspection. Others teach in colleges and universities or work as consultants.

Places of Employment

About 180,000 civil engineers were employed in 1972. Most work for Federal, State, and local government agencies and in the construction industry. Many work for consulting engineering and architectural firms or as independent consulting engineers. Others work for public utilities, railroads, edu-

Engineers supervise construction of buildings and other projects.

cational institutions, and in the iron and steel and other major manufacturing industries.

Civil engineers work in all parts of the country, usually in or near major industrial and commercial centers. They are often called upon to work at construction sites, and are sometimes stationed in remote areas or in foreign countries. In some jobs, they must often move from place to place to work on different projects.

Employment Outlook

Opportunities for civil engineers should increase rapidly through the mid-1980's. Job opportunities will result from the growing needs for housing, industrial buildings, and highway transportation systems created by an increasing population and expanding economy. Work related to problems of urban environment, such as water and sewage systems, air and water pollution, urban redevelopment, and rapid transit systems may require additional civil engineers.

Large numbers of civil engineers also will be needed each year to replace those who retire or die. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

American Society of Civil Engineers
345 East 47th St., New York, N.Y. 10017.

ELECTRICAL ENGINEERS

(D.O.T. 003.081, .151, and .187)

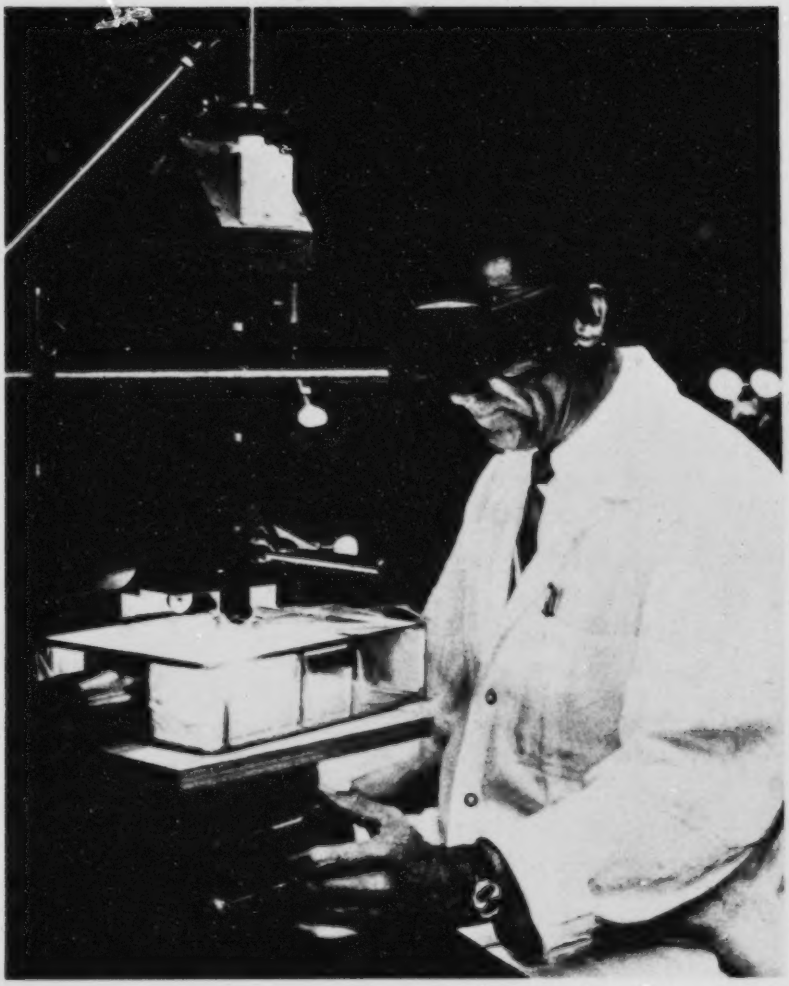
Nature of the Work

Electrical engineers design, develop, and supervise the manufacture of electrical and electronic equipment. These include electric motors and generators; communications equipment; electronic equipment such as heart pacemakers, pollution measuring instrumentation, radar, computers, lasers, and missile guidance systems; and electrical appliances of all kinds. They also design and assist in operating facilities for generating and distributing electrical power.

Electrical engineers generally specialize in a major area of work such as electronics, electrical equipment manufacturing, communications, or power. Others specialize in subdivisions of these broad areas like computers or missile guidance and tracking systems. Many are engaged in research, development, and design activities. Some are in administrative and management jobs; others work in various manufacturing operations or in technical sales or teaching jobs.

Places of Employment

Electrical engineering is the largest branch of the profession. More than 230,000 electrical engineers were employed in 1972, mainly by manufacturers of electrical and electronic equipment, aircraft and parts, business machines, and professional and scientific equipment. Many work for telephone, telegraph, and electric light and power companies. Large numbers are employed by government agencies and by colleges and universities. Others work for construction firms, for engineering consultants, or as independent consulting engineers.



Electrical engineers work with lasers.

Employment Outlook

Job opportunities for electrical engineers are expected to increase very rapidly through the mid-1980's. Increased demand for electrical equipment to automatically control production processes, using such items as computers and sensing devices, is expected to be among the major factors contributing to this growth. The demand for electrical and electronic consumer goods along with increased research and development in nuclear power generation should create job openings for electrical engineers. Many electrical engineers also will be needed to replace personnel who retire or die.

The long range outlook for electrical engineers assumes that defense spending in the mid-1980's will be somewhat lower than the peak Vietnam levels. If defense activity should differ substantially from that level, the demand for electrical engineers will be affected.

(See introductory part of this section for information on training requirements and earnings. See also statement on Electronics Manufacturing elsewhere in the *Handbook*.)

Sources of Additional Information

Institute of Electrical and Electronic Engineers, 345 East 47th St., New York, N.Y. 10017.

INDUSTRIAL ENGINEERS

(D.O.T. 012.081, .168, and .188)

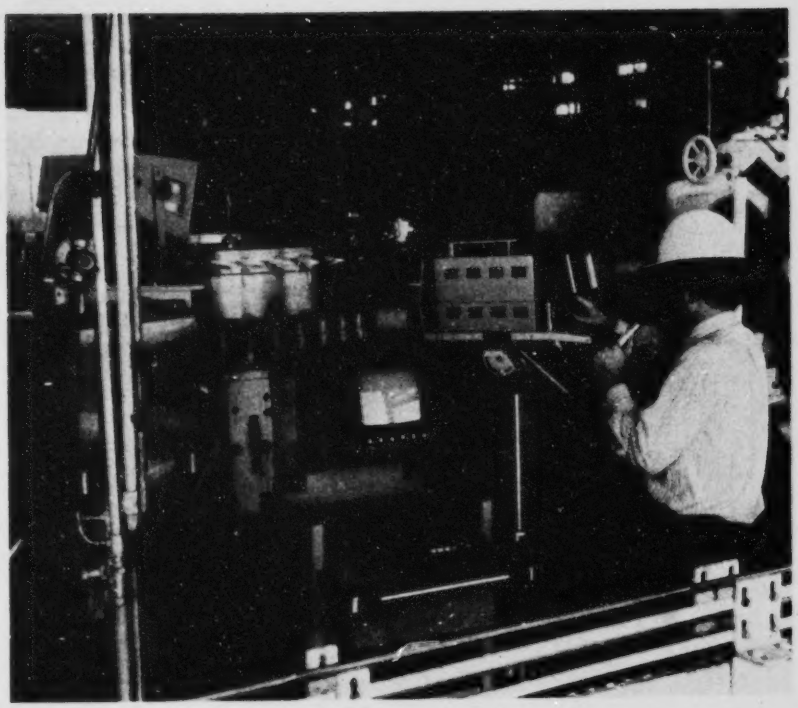
Nature of the Work

Industrial engineers determine the most effective methods of using the basic factors of production—manpower, machines, and materials. They are more concerned with people and "things," in contrast to engineers in other specialties who generally are concerned more with developmental work in their fields, such as power and mechanics.

They design systems for data processing and apply operations research techniques to organizational, production, and related problems. Industrial engineers also develop management control systems to aid in financial planning and cost analysis. They design production planning and control systems to coordinate activities and control product quality, and may design and improve systems for the physical distribution of goods and services. Other activities include plant location surveys, where they must consider sources of raw materials, the work force, financing, taxes, and the development of wage and salary administration and job evaluation programs.

Places of Employment

About 125,000 industrial engineers were employed in 1972; more



Industrial engineer tapes operation to check for problems.

than two-thirds worked in manufacturing industries. They are more widely distributed among manufacturing industries than are those in other branches of engineering. Some work for insurance companies, banks, construction and mining firms, and public utilities. Hospitals, retail organizations, and other large business firms employ industrial engineers to improve operating efficiency. Still others work for government agencies and educational institutions. A few are independent consulting engineers.

Employment Outlook

Opportunities for industrial engineers are expected to grow very rapidly through the mid-1980's. The increasing complexity of industrial operations and the expansion of automated processes, along with industry growth, are factors contributing to increased requirements for these engineers. Increased recognition of the importance of scientific management and safety engineering in reducing costs and increasing productivity, and newer areas of work such as noise, air, and water pollution control should create additional opportunities.

Additional numbers of industrial engineers will be required each year to replace those who retire, die, or transfer to other occupations. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

American Institute of Industrial Engineers, Inc., 25 Technology Park/ Atlanta, Norcross, Ga. 30071.

MECHANICAL ENGINEERS

(D.O.T. 007.081, .151, .168, .181, and .187; 011.081, and 019.187)

Nature of the Work

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop machines that produce power, such as internal combustion engines, steam and gas turbines, jet and rocket engines, and nuclear reactors. They also design and develop a great variety of machines that use power—refrigeration and air-conditioning equipment, elevators, machine tools, printing presses, steel rolling mills, and many others.

Many specialized areas of work have developed within this field and, since mechanical engineers are employed in nearly all industries, their work varies with the industry and the function performed. Among these specialties are motor vehicles, marine equipment, steampower, heating, ventilating and air-conditioning, instrumentation, and machines for specialized industries, such as petroleum, rubber and plastics, and construction.

Large numbers of mechanical engineers do research, development, test, and design work. Many work in administrative and management activities. Others work in maintenance, marketing and sales, and activities related to production and operations in manufacturing. Some teach in colleges and universities or work as consultants.

Places of Employment

About 210,000 mechanical engineers were employed in 1972. Almost three-fourths were employed in manufacturing—mainly in the

primary and fabricated metals, machinery, transportation equipment, and electrical equipment industries. Others work for government agencies, educational institutions, and consulting engineering firms.

Employment Outlook

Opportunities for mechanical engineers are expected to grow rapidly through the mid-1980's. The expansion of industry along with the demand for industrial machinery and machine tools and the increasing complexity of industrial machinery and processes will be major factors supporting increased employment opportunities. Expenditures for research and development also will be a factor in the growth. Newer areas of work, such as atomic energy and environmental control, will provide additional openings.

Large numbers of mechanical engineers also will be required each year to replace those who retire or die. (See introductory part of this section for information on training requirements and earnings. See also statement on Occupations the Atomic Energy Field elsewhere in the *Handbook*.)

Sources of Additional Information

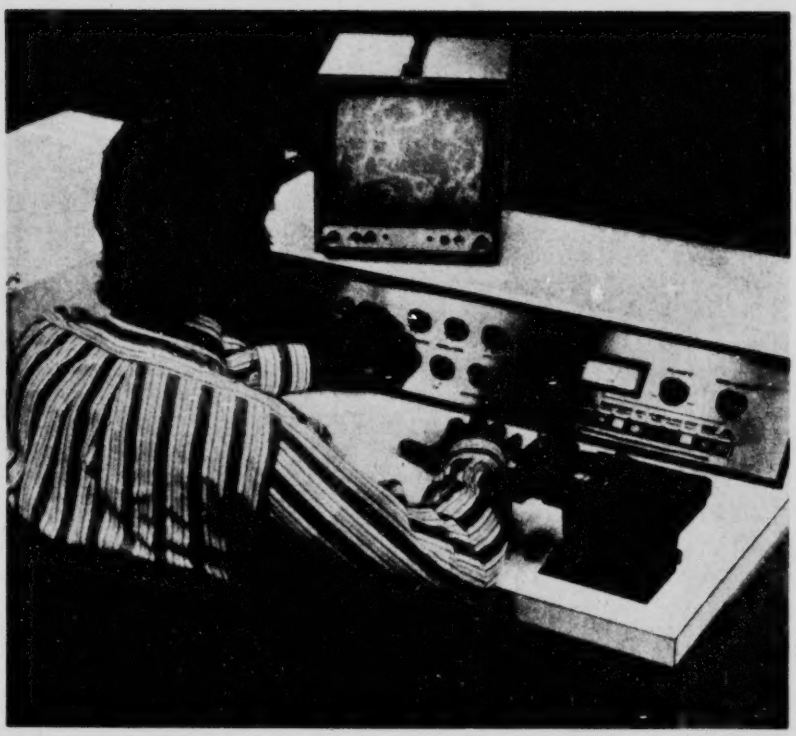
The American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y. 10017.

METALLURGICAL ENGINEERS

(D.O.T. 011.081)

Nature of the Work

Metallurgical engineers develop methods to process and convert metals into useful products. These engineers generally work in one of the three main branches of metallurgy—extractive or chemical, physical, and mechanical. Extractive metallurgy involves the extraction of metals from ores and refining and alloying them to obtain pure metal. Physical metallurgy deals with the nature, structure and physical properties of metals and their alloys, and with methods of converting refined metals into final products. Mechanical metallurgy involves the working and shaping of metals by casting, forging, rolling and drawing. Scientists working in this field are known as metallurgists but the distinction between scientists and engineers is small. People working in the field of metallurgy are increasingly being referred to as either materials scientists or materials engineers.



Metallurgical engineers use scientific equipment to study the structural make-up of materials.

Places of Employment

The metalworking industries—primarily the iron and steel and nonferrous metals industries—employed over one-half of the estimated 10,000 metallurgical engineers in 1972. Many metallurgical engineers work in industries that manufacture machinery, electrical equipment, and aircraft and parts. Others work in the mining industry. Some work for government agencies, consulting firms, independent research organizations, and colleges and universities.

Employment Outlook

Employment opportunities for

metallurgical engineers are expected to grow very rapidly through the mid-1980's. An increasing number of these engineers will be needed by the metalworking industries to develop new metals and alloys as well as to adapt current ones to new needs. For example, the development of such products as supersonic jet aircrafts, missiles, satellites, spacecrafts, and computers has brought about a need for lightweight metals of high purity, able to withstand both extremely high and low temperatures. Metallurgical engineers also will be needed to solve metallurgical problems associated with the efficient use of nuclear energy. As the supply of high-grade ores diminishes, more metallurgical engineers will be required to find new ways of recycling solid waste materials in addition to processing low-grade ores now regarded as unprofitable to mine. They also will be needed to solve problems connected with air and water pollution control, noise abatement, urban renewal, public transportation, and biomedical devices. (See introductory part of this section for information on training requirements and earnings. Also see statement on the Iron and Steel Industry elsewhere in the *Handbook*.)

Sources of Additional Information

The Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers 345 East 47th St., New York, N.Y. 10017.

American Society of Metals, Metals Park, Ohio 44073.

MINING ENGINEERS

(D.O.T. 010.081 and .187)

Nature of the Work

Mining engineers find, extract, and prepare minerals for manufacturing industries to use. They design the layouts of mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods for transporting minerals to processing plants. Mining engineers are responsible for the efficient operation of mines and mine safety, including ventilation, water supply, power, communications, and equipment maintenance. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment and devise improved methods to process extracted minerals. With increased emphasis on the environment, many mining engineers have been working to solve problems related to mined-land reclamation and water and air pollution control.

Mining engineers frequently specialize in the extraction of specific metal ores, coal, and other nonmetallic minerals. Engineers who specialize in the extraction of petroleum and natural gas are usually considered members of a separate branch of the engineering profession—Petroleum Engineering.

Mining engineers are concerned with mine safety.

Places of Employment

About 5,000 mining engineers were employed in 1972. Most work in the mining industry. Some work in colleges and universities, for government agencies, or as independent consultants. Others work for firms that produce equipment for the mining industry.

Mining engineers are usually employed at the location of mineral deposits, often near small communities. However, those in research, teaching, management, consulting, or sales are often located in large metropolitan areas.

Employment Outlook

Employment opportunities for mining engineers are expected to be favorable through the mid-1980's. The number of new graduates in mining engineering is expected to be fewer than the number needed to replace those who die, retire, or transfer to other fields of work.

Exploration for minerals is increasing, both in the United States and in other parts of the world. Easily mined deposits are being depleted, creating a growing need for engineers to mine newly discovered mineral deposits and to devise more efficient methods for mining low-grade ores. Additional employment opportunities for mining engineers will arise as new alloys and new uses for metals increase the demand for less widely used ores. Recovery of metals from the sea and the development of recently discovered oil shale deposits could present major challenges to the mining engineer. (See introductory part of this section for information on training requirements and earnings. See also statement on Mining elsewhere in the *Handbook*.)

Sources of Additional Information

The Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers
345 East 47th St., New York, N.Y. 10017.

ENVIRONMENTAL SCIENTISTS

Environmental scientists help us live within our physical environment. They play an important role in solving environmental pollution problems. These scientists, sometimes known as earth scientists, are concerned with the history, composition, and characteristics of the earth's surface, interior, and atmosphere. Some do basic research to increase scientific knowledge. Others solve practical problems. Geologists, for example, explore for new sources of oil, other fuels, and ores. Still others do applied research and use knowledge gained from basic research to help answer important questions. Meteorologists, for example, use scientific knowledge to forecast the weather. Many environmental scientists teach in colleges and universities. Others administer scientific programs and operations.

Many environmental scientists specialize in one particular branch of their broad occupational field. This chapter discusses the specialties and the employment outlook for four environmental science occupations—geologists, geophysicists, meteorologists, and oceanographers.

GEOLOGISTS

(D.O.T. 024.081)

Nature of the Work

Geologists study the structure, composition, and history of the earth's crust in order to locate natural resources, give warnings of natural disasters, and help see that buildings are put on firm foundations. By examining rocks and drilling to recover rock cores, they determine their distribution, thickness, and slope beneath the earth's surface. They also identify rocks and minerals, conduct geological surveys, draw maps, take measurements, and record data.

Geologists use many tools and instruments such as hammers, chisels, levels, transits (mounted telescopes used to measure angles), gravity meters, cameras, compasses, and seismographs (instruments that record the intensity and duration of earthquakes and earth tremors). They also evaluate information from photographs taken from aircraft and satellites and use computers to record and analyze data.

Geologists also work in laboratories where they examine the chemical and physical properties of specimens under controlled temperature and pressure. They may study fossil remains of animal and vegetable life or experiment with the flow of water and oil through rocks. Laboratory equipment used by geologists includes complex instruments such as the X-ray diffractometer, which determines the structure of minerals, and the petrographic microscope for close study of rock formations.

Geologists do other things besides locating resources and working in laboratories. They advise construction companies, and Federal, State, and local governments on the suitability of certain locations for constructing buildings, dams, or highways. Some geologists administer and manage research and exploration programs. Others teach and work on research projects in colleges and universities.

Geologists usually specialize in one or a combination of three general areas—earth materials, earth processes, and earth history.

Economic geologists locate earth materials such as minerals and solid fuels. *Petroleum geologists* search for and recover liquid fuels—oil and natural gas. Some petroleum geologists work near drilling sites and others correlate petroleum-related geologic knowledge for entire regions. *Engineering geologists* determine suitable sites for the construction of roads, airfields, tunnels, dams, and other structures. They decide, for example, whether underground rocks will bear the weight of a building or whether a structure may be in an earthquake prone area. *Mineralogists* analyze and classify minerals and precious stones according to composition and structure. *Geochemists* study the chemical composition and changes in minerals and rocks to understand the distribution and migration of elements in the earth's crust.

Geologists concerned with earth processes study landforms and their rock masses, sedimentary (matter deposited by water or wind) deposits and eruptive forces such as volcanoes. *Volcanologists* study active and inactive volcanoes, lava flows, and other eruptive activity. *Geomorphologists* examine landforms and forces such as erosion and glaciation which cause them to change.

Other geologists are most concerned with earth history. *Paleontologists* study plant and animal fossils to trace the evolution and development of past life. *Geo-*

chronologists determine the age of rocks and landforms by the radioactive decay of its elements. *Stratigraphers* study the distribution and arrangement of sedimentary rock layers by examining their fossil and mineral content.

Many geologists specialize in new fields that require knowledge of another science. *Astrogeologists* study geological conditions on other planets. *Geological oceanographers* study the sedimentary and other rock on the ocean floor and continental shelf. (See statements on Oceanographers and Mining elsewhere in the *Handbook*.)

Places of Employment

About 23,000 people worked as geologists in 1972, over half in private industry. Most industrial geologists work for petroleum producers, many for American companies exploring in foreign nations. Geologists also work for mining and quarrying companies. Some are employed by construction firms and others are independent consultants to industry and government.

The Federal Government employs over 1,600 geologists. Two-thirds work for the Department of the Interior in the U.S. Geological Survey, the Bureau of Mines, and the Bureau of Reclamation. State agencies also employ geologists, some working on surveys in cooperation with the U.S. Geological Survey.

Colleges and universities employ almost 7,500 geologists. Some work for nonprofit research institutions and museums

Geologists should like outdoor work.

Training, Qualifications, and Advancement

Students seeking professional careers as geologists should earn an advanced degree. The master's degree is required for beginning research and teaching and most exploration jobs. Advancement in college teaching and high-level research and administrative posts usually require the Ph.D. The bachelor's degree is adequate training for some entry jobs in exploration work.

About 300 colleges and universities offer a bachelor's degree in geology. Undergraduate students devote about one-fourth of their time to geology courses, including historical geology, structural geology, mineralogy, petrology, and invertebrate paleontology. Students spend about a third of their time taking mathematics, related sciences—such as physics and chemistry—and engineering; the remainder is general academic subjects. Statistics and computer courses are especially recommended.

More than 160 universities award advanced degrees in geology. Graduate students take advanced courses in geology and specialize in one branch of the science.

Students planning careers in exploration geology should like the outdoors, and have physical stamina. They should be able to adapt to changes brought about by travel to distant countries. Geologists often travel to remote sites by helicopter and jeep and cover large areas by foot. Generally, they work in teams. Geologists need curious and analytical minds to solve complex geological problems.

Geologists with advanced degrees

usually begin their careers in field exploration or as research assistants in laboratories. After suitable experience, they may be promoted to project leaders, program managers, or other management and research positions.

Employment Outlook

Employment opportunities for geologists with advanced degrees are expected to be favorable through the mid-1980's. Hundreds of opportunities should open up each year because of the expected growth in the field and to replace geologists who are promoted to managerial positions, transfer to other fields, die, or retire. Those with bachelor's degrees may face competition for entry jobs and some may have to work as technicians or surveyors. For those with only bachelor's degrees, opportunities will be more favorable with some training in geophysical exploration techniques.

Demand for geologists will continue in Federal agencies, particularly the U.S. Geological Survey. College and university employment probably will rise, mainly for those having Ph.D. degrees.

Geologists may want to consider related employment activities outside the field. For instance, geologists may take training to qualify as science teachers in secondary schools.

Consumer and industrial demand for petroleum and minerals will continue to rise, and geologists with advanced degrees will be required to locate and recover new deposits to fill increased demand and replenish old supplies. However, indications are that employment of geologists with advanced degrees in petroleum and mineral extraction will be more limited in the near future than in the past. Additional geologists will be needed to discover new resources and their potential uses. For example, geologists will help determine the feasibility of using geothermal energy (steam from the earth's interior) to generate electricity. Geologists also are needed to devise techniques for exploring deeper within the earth's crust and to develop more efficient methods of mining resources. Geologists also are needed to develop adequate water supplies, waste disposal methods, and building materials and site evaluation for construction activities. Increased emphasis on the environment by urban societies also should affect requirements for geologists. For example, pollution control, better land use and reclamation programs, and highway construction activities require the talents of geologists.

Earnings and Working Conditions

Geologists have relatively high salaries, with average earnings over twice those received by nonsupervisory workers in private industry, except farming.

Starting salaries for new graduates averaged $9,000 a year in 1972 for those having a bachelor's degree, $11,000 for those having a master's degree, and $13,000 for those having a doctorate, according to the American Geological Institute's annual survey.

In the Federal Government in early 1973, geologists having a bachelor's degree could begin at $7,694 or $9,520 a year, depending on their college records. Beginning geologists having the master's degree could start at $9,520 or $11,614, depending on their academic records or previous work experience. Those having the Ph.D. degree could begin at $13,996 or $16,682.

Geologists often work outdoors in many different climates and geographical areas. Field work requires hard physical labor and long hours with limited companionship. Geologists in mining may be required to work underground. When not working outdoors, they are in comfortable, well-lighted, well-ventillated offices and laboratories.

Sources of Additional Information

General information on career opportunities, training, and earnings for geologists is available from:

American Geological Institute, 2201 M St. NW., Washington, D.C. 20037.

For information on Federal Government careers contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C. 1900 E St. NW., Washington, D.C. 20415.

GEOPHYSICISTS

(D.O.T. 024.081)

Nature of the Work

Geophysicists study the composition and physical aspects of the earth and other planets—their interiors, surfaces, and atmospheres. They investigate the earth's physical characteristics, such as its electric, magnetic, and gravitational fields. Geophysicists use highly complex instruments such as the magnetometer which measures variations in the earth's magnetic field, and the gravimeter which measures minute variations in gravitational attraction. They may use satellites

to conduct tests in outer space and use computers to collect and analyze data.

Geophysicists usually specialize in one of three general phases of the science—solid earth, fluid earth, and upper atmosphere.

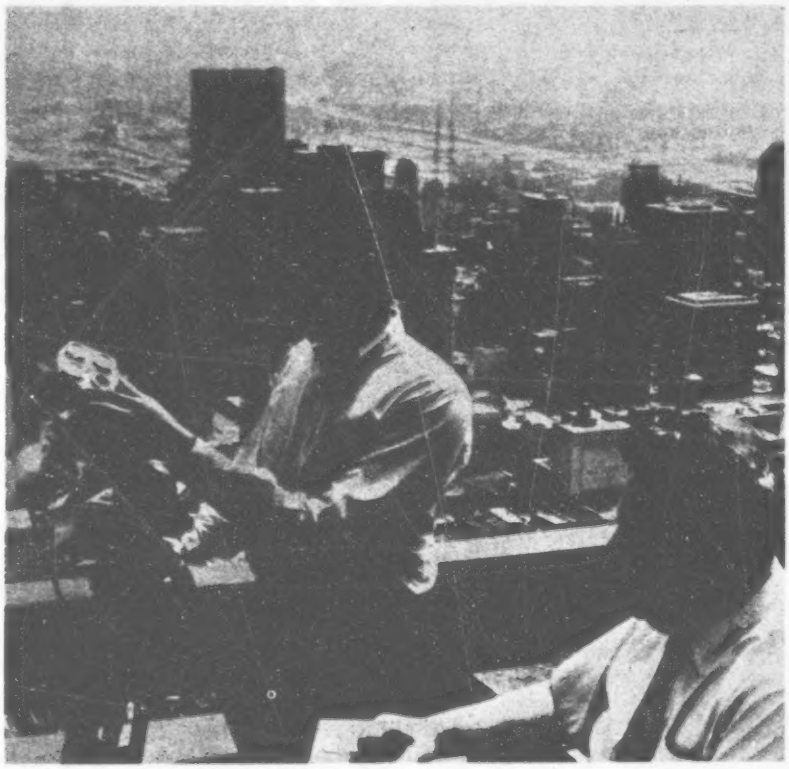
Solid earth geophysicists search for oil and mineral deposits, map the earth's surface, and are concerned with earthquakes. *Exploration geophysicists* use seismic prospecting techniques to locate oil and mineral deposits. They send sound waves into the earth and record the echoes bouncing off the rock layers below to determine if they are favorable for the accumulation of oil.

Seismologists study the earth's interior and earth vibrations caused by earthquakes and manmade explosions. They explore for oil and minerals, study underground detection of nuclear explosions, and provide information for use in constructing bridges, dams, and buildings. For example, in constructing a dam, seismologists determine where bedrock (solid rock beneath the soil) is closest to the surface so the best dam site can be selected. They use explosives to create sound waves which reflect off bedrock; the time it takes for the shock wave to return to the surface indicates the depth of bedrock.

Geodesists study the size, shape, and gravitational field of the earth and other planets. Their principal task is mapping the earth's surface. With the aid of satellites, geodesists determine the positions, elevations, and distances between points on the earth, and measure the intensity and direction of gravitational attraction.

Hydrologists are concerned with the fluid earth. They study the distribution, circulation, and physical properties of underground and surface waters, including glaciers, snow, and permafrost. They also study rainfall and its rate of infiltration into soil. Some are concerned with water supplies, irrigation, flood control, and soil erosion. (See statement on Oceanographers, sometimes classified as geophysical scientists, elsewhere in the *Handbook*.)

Geophysicists involved in the atmosphere investigate the earth's magnetic and electric fields and compare its outer atmosphere with those of other planets. *Geomagneticians* study the earth's magnetic field. *Paleomagneticians* learn about past magnetic fields from rocks or lava flows. *Planetologists* study the composition and atmosphere of the moon, planets, and other bodies in the solar system. They gather data from geophysical instruments placed on inter-planetary space probes or equipment used by astronauts during the Apollo missions. *Meteorologists* are sometimes classified as geophysical scientists. (See statements on Meteorologists and Mining elsewhere in the *Handbook*.)



Geophysicists measure solar radiation.

Places of Employment

More than 8,000 people worked as geophysicists in 1972. Most work in private industry, chiefly for petroleum and natural gas companies. Other geophysicists are in mining companies, exploration and consulting firms, and research institutes. A few are independent consultants and some do geophysical prospecting on a fee or contract basis.

Geophysicists are employed in many southwestern and western States, including the Gulf Coast, where large oil and natural gas fields are located. Some geophysicists are employed by American firms overseas for varying periods of time.

Over 2,000 geophysicists, geod-

esists, and hydrologists worked for Federal Government agencies in 1972, mainly the U.S. Geological Survey; the National Oceanic and Atmospheric Administration (NOAA); the Army Map Service; and the Naval Oceanographic Office. Other geophysicists work for colleges and universities, State governments, and nonprofit research institutions.

Training, Other Qualifications, and Advancement

A person with a bachelor's degree in geophysics or a geophysical specialty qualifies for most beginning jobs in exploration geophysics. A bachelor's degree in a related field of science or engineering also is adequate preparation, provided the person has courses in geophysics, physics, geology, mathematics, chemistry, and engineering. A geophysicist with a background in electronic data processing can increase his employment opportunities in industry and government.

Geophysicists doing research or supervising exploration activities should have graduate training in geophysics or a related science. Those planning to teach in colleges or do basic research should acquire a Ph.D. degree in geophysics or a related science with advanced courses in geophysics.

About 50 colleges and universities award the bachelor's degree in geophysics. Other programs offering training for beginning geophysicists include geophysical technology, geophysical engineering, engineering geology, petroleum geology, and geodesy.

More than 60 universities grant the master's and Ph.D. degree in geophysics. People who have a bachelor's degree and courses in geology, mathematics, physics, engineering or a combination of these subjects can be admitted to these graduate schools

Geophysicists should be in good health since they often have to work outdoors, and must be willing to travel, sometimes for extended periods of time. Geophysicists generally work as part of a team. They should have curious and analytical minds for solving complex geophysical problems and be able to express themselves both orally and in writing.

Most new geophysicists begin their careers doing field mapping or other exploration activities. Some assist senior geophysicists in research laboratories. With suitable experience, geophysicists advance to project leader, program manager, or other management and administrative jobs.

Employment Outlook

New graduates in geophysics should have good employment opportunities through the mid-1980's. In addition to opportunities resulting from the very rapid growth expected in this field, a few hundred geophysicists will be needed each year to replace those who transfer to other fields of work, retire, or die. Although the number of job openings for geophysicists is not expected to be large in any one year, the number of new geophysics graduates is not expected to meet requirements.

Federal Government agencies may need geophysicists for new or expanding programs. Jobs for geophysicists in the Federal Government are heavily dependent on funds for research and development in the earth sciences, which are expected to increase through the mid 1980's but at a slower rate than during the 1960's. The Government is expected to support additional research to develop "natural disaster technology" to improve capabilities to control, predict, or reduce destruction from fires, earthquakes, floods, hurricanes, and severe storms. The Government also may support research to locate more natural resources, prevent environmental degradation through better land use, and improve municipal services such as water and sewage disposal.

Petroleum and mining companies will need geophysicists for exploration activities, which are expected to expand through the mid-1980's. As the need for more fuel and minerals grows and costs of exploration increase, more geophysicists will be needed to operate sophisticated electronic equipment to find the more concealed fuel and mineral deposits.

In addition, geophysicists with advanced training will be needed to do research into radioactivity and cosmic and solar radiation, investigate the use of geothermal power (steam from the earth's interior) as a source of energy to generate electricity, and contribute to exploration of outer space. Geophysicists also will be needed to develop better geophysical instruments, and to establish information storage and retrieval systems for geophysical libraries.

Earnings and Working Conditions

Geophysicists have relatively high salaries, with average earnings more than twice those received by nonsupervisory workers in private industry, except farming.

Starting salaries in 1972 for geophysics graduates averaged $9,000 a year for those having a bachelor's degree, $11,000 for those having a master's degree and $13,000 for those having a doctorate, according to the American Geological Institute's annual survey.

In the Federal Government in

early 1973, geophysicists having a bachelor's degree could begin at $7,694 or $9,520 a year, depending on their college records. Beginning geophysicists having a master's degree could start at $9,520 or $11,614 depending on their academic record or previous work experience. Those having a Ph.D. degree could begin at $13,996 or $16,682.

Geophysicists work outdoors for extended periods of time with limited companionship. Some of them work in remote areas, involving much traveling and living under primitive conditions. Geophysicists also work in modern, well-equipped, well-lighted laboratories and offices.

Sources of Additional Information

General information on career opportunities, training, and earnings for geophysicists is available from:

American Geophysical Union, 1707 L St. NW., Washington, D.C. 20036.

Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, Okla. 74101.

For information on Federal Government careers contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St., NW., Washington, D.C. 20415.

METEOROLOGISTS

(D.O.T. 025.088)

Nature of the Work

Meteorology is the study of the atmospheres—the gases that surround the earth and other celestial bodies. Meteorologists describe and try to understand the atmospheres' physical composition, motions, and processes, and determine the way these elements affect the rest of our physical environment. This study helps solve many practical problems in agriculture, transportation, communications, health, defense, and business.

Meteorologists usually specialize in one branch of the science. Weather forecasters, known professionally as *synoptic meteorologists*, are the largest group of specialists. They study current weather information, such as air pressure, temperature, humidity, and wind velocity in order to make short- and long-range predictions. Their data come from weather satellites and observers in many parts of the world. Although some forecasters still prepare and analyze weather maps, most data now are plotted by computers.

Some meteorologists are engaged in basic and applied scientific research. For example, *physical meteorologists* study the chemical and electrical properties of the atmosphere. They do research on the effect of the atmosphere on transmission of light, sound, and radio waves, as well as factors affecting formation of clouds, rain, snow, and other weather conditions. Other meteorologists, known as *climatologists*, study historical climate conditions and analyze past records on wind, rainfall, sunshine, and temperature to determine the general pattern of weather that makes up an area's climate. These studies are useful in planning heating and cooling systems, designing buildings, and aiding in effective land utilization.

Meteorological instrumentation specialists develop the devices that measure, record, and evaluate data on atmospheric processes. For example, some of these instruments are used to measure the size and number of droplets in a cloud, structure of winds, and pressure, humidity, and temperature miles above the earth.

Specialists in applied methodology, sometimes called *industrial*

Meteorologist checks the position of a major storm from weather satellite photographs.

meteorologists, study the relationship between weather and specific human activities, biological processes, and agricultural and industrial operations. For example, they make weather forecasts for individual companies, attempt to induce rain or snow in a given area, and work on problems such as smoke control and air pollution abatement.

About one-third of all civilian meteorologists work primarily in weather forecasting, and another one-fourth manage or administer forecasting and research programs. Almost one-fourth work in research and development. For example, they devise mathematical models of atmospheric motion to understand and predict changing weather conditions, or carry out experiments in changing the amount of rain in an area.

Some meteorologists teach or do research—frequently combining both activities—in colleges and universities. In colleges without separate departments of meteorology, they may teach geography, mathematics, physics, chemistry, or geology, as well as meteorology.

Places of Employment

About 5,000 persons—10 percent of them women—worked as meteorologists in 1972. In addition to these civilian meteorologists, more than 2,000 officers and 7,000 enlisted members of the Armed Forces did forecasting and other meteorological work.

The largest employer of civilians was the National Oceanic and Atmospheric Administration (NOAA), where nearly 2,000 meteorologists worked at 300 stations in all parts of the United States, and in a small number of foreign areas. The Department of Defense employed over 300 civilian meteorologists.

More than 1,000 meteorologists worked for private industry. Commercial airlines employed several hundred to forecast weather along flight routes and to brief pilots on atmospheric conditions. Others worked for private weather consulting firms, for companies that design and manufacture meteorological instruments, for radio and television stations, and for large firms in aerospace, insurance, utilities, and other industries.

Colleges and universities employed almost 1,000 meteorologists in research and teaching. A few worked for State and local governments and for nonprofit organizations.

Although meteorologists work in all States, nearly two-fifths live in just two States—California and Maryland. More than one-tenth of all meteorologists worked in the Washington, D.C. area.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in meteorology is the usual minimum requirement for beginning jobs in weather forecasting. However, a bachelor's degree in a related science or engineering, along with some courses in meteorology, is acceptable for some jobs. For example, the Federal Government's minimum requirement for beginning jobs is a bachelor's degree with at least 20 semester hours of study in meteorology and additional training in physics and mathematics, including calculus.

For research and college teaching and for many top-level positions in other meteorological activities, an advanced degree is essential, preferably in meteorology. However, people with graduate degrees in other sciences also may qualify if they have advanced courses in meteorology, physics, mathematics, and chemistry.

In 1972, 42 colleges and universities offered a bachelor's degree in meteorology; 53 schools offered advanced degrees in atmospheric science. Many other institutions offered some courses in meteorology.

The Armed Services give and support meteorological training, both of enlisted personnel for undergraduate education and of officers for advanced study.

NOAA has a program under which some of its meteorologists may attend college for advanced or specialized training. College students can obtain summer jobs with this agency or enroll in its cooperative education program in which they work at NOAA part of the year and attend school part of the year. In addition to helping students finance their education this program gives them valuable experience for finding a job when they graduate.

Meteorologists in the Federal Government usually start in 2-year training positions at weather stations. They observe weather conditions, receive training in forecasting, and release weather information to the public, agriculture industry, airlines, and other specialized users. Advancement is to assistant forecaster and forecaster.

Airline meteorologists have somewhat limited opportunities for advancement. However, after considerable work experience, they may advance to flight dispatcher or to various supervisory or administrative jobs. A few very well qualified meteorologists with a background in science, engineering, and business administration may establish their own weather consulting services.

Employment Outlook

Employment of meteorologists is expected to grow moderately through the mid-1980's. In addition to openings resulting from growth,

some meteorologists will be needed each year to replace those who retire, die, or transfer to other fields. Employment opportunities should be favorable during this period, especially for those with advanced degrees who will find jobs in research, teaching in colleges and universities, as well as in management and consulting work.

The use of weather satellites, manned spacecraft, world-circling weather balloons, and electronic computers has expanded the work of meteorologists. These advances have made possible the study of weather and climate on a global scale. Meteorologists also will find jobs developing and improving instruments for collecting and processing weather data.

Job opportunities for meteorologists with commercial airlines, weather consulting services, and other private companies are expected to increase as the value of weather information to all segments of our economy receives further recognition. For example, the atmosphere is an important part of our environment, and increasing public concern about ecology could create job openings with private research organizations, in colleges and universities, and in State and local governments.

The need will continue for meteorologists to work in existing programs, such as weather measurements and forecasts and do research on problems of severe storms, turbulance, and air pollution.

Earnings and Working Conditions

Meteorologists have relatively high earnings, salaries were about twice the average received by nonsupervisory workers in private industry, except farming.

In early 1973, meteorologists in the Federal Government with a bachelor's degree and no experience received starting salaries of $7,619 or $9,520 a year, depending on their college grades. Those with a master's degree could start at $11,614 or $13,996, and those with the Ph.D. degree at $13,996 or $16,682. Salaries were higher for those who worked outside the United States.

Airline meteorologists had average starting salaries of $12,000 a year, according to the Air Traffic Conference. They generally receive the same benefits as other airline employees. (See Statement on Occupations in Civil Aviation elsewhere in the *Handbook*.) Those teaching in colleges and universities earned salaries equivalent to those received by other faculty members. (See Statement on College and University Teachers.)

Jobs in weather stations, which are operated on a 24-hour, 7-day week basis, often involve nightwork and rotating shifts. Most stations are at airports or at places in or near cities; some are in isolated and remote areas. Meteorologists generally work alone in smaller weather stations, and as part of a team in larger ones.

Sources of Additional Information

General information on career opportunities and schools offering education in meteorology is available from:

American Meteorology Society, 45 Beacon St., Boston, Mass. 02108.

American Geophysical Union, 2100 Pennsylvania Ave., NW., Washington, D.C. 20037.

For facts about job opportunities with the NOAA National Weather Service and on its student cooperative education program, contact:

Personnel Division AD 41, National Oceanic and Atmospheric Administration, 6010 Executive Blvd., Rockville, Md. 20852.

Details about Air Force meteorological training programs are available from any Air Force recruiting office or from:

Air Weather Service/D.O.T., Stop 400 Scott Air Force Base, Ill. 62225.

OCEANOGRAPHERS

(D.O.T. 024.081 and 041.081)

Nature of the Work

Oceans cover more than two-thirds of the earth's surface and provide people with valuable foods, fossil fuels, and minerals. They also influence the weather, serve as a "highway" for transportation, and offer many kinds of recreation. Oceanographers use the principles and techniques of natural science, mathematics, and engineering to study oceans—their movements, physical properties, and plant and animal life. Their research not only extends basic scientific knowledge, but also helps develop practical methods for forecasting weather, developing fisheries, mining ocean resources, and improving National defense.

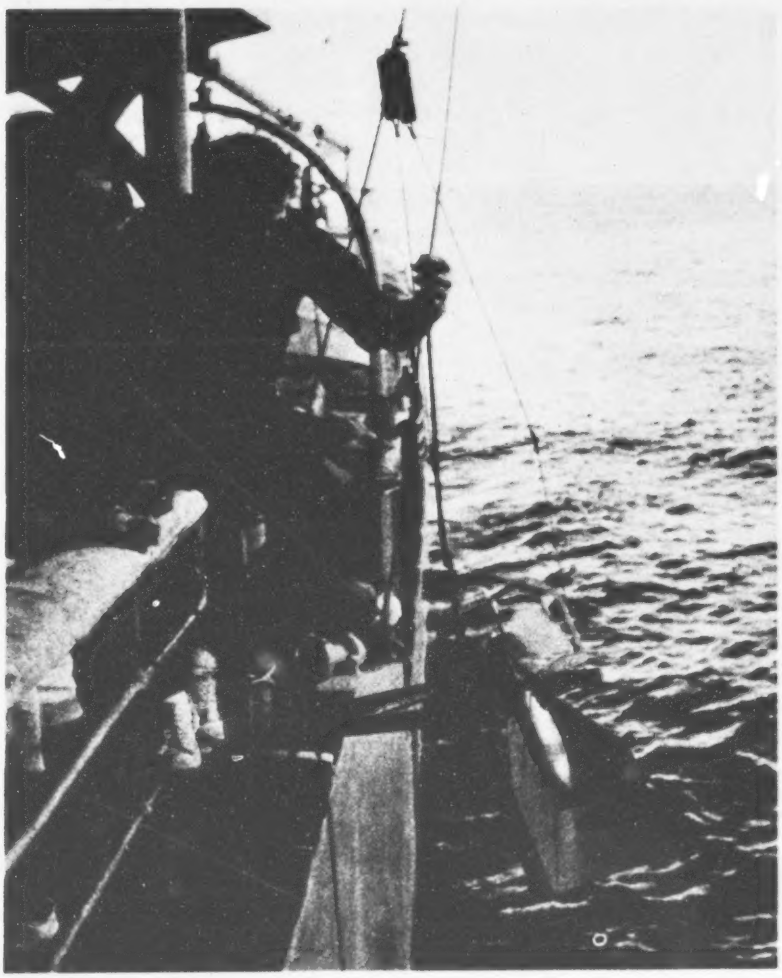
Some oceanographers make tests and observations, and conduct experiments from ships or stationary platforms in the sea. They may study and collect data on ocean tides, currents, and other phenomena. Some study undersea mountain ranges and valleys, oceanic interaction with the atmosphere, and layers of sediment on and beneath the ocean floor.

Oceanographers also work in laboratories on land where, for example, they measure, dissect, and photograph fish. They also study exotic sea specimens and plankton (floating microscopic plants and animals). Much of their work entails identifying, cataloguing, and

analyzing different kinds of sea life and minerals. At other laboratories, oceanographers plot maps or feed data to computers to test theories about the ocean. For example, they may study and test the theory of continental drift, which states that the continents were once joined together, have drifted apart, and continue to drift apart causing the sea floor to spread. To present the results of their studies, oceanographers prepare charts, tabulations, reports and manuals, and write papers for scientific journals.

Oceanographers explore and study the ocean with low-flying aircraft as well as surface ships. They use specialized instruments to measure and record the findings of their explorations and studies. Special cameras equipped with strong lights photograph marine life and the ocean floor. Sounding devices are vital to the oceanographer for communicating with teammates above the water and for measuring, mapping, and locating ocean materials.

Most oceanographers specialize in one branch of the science. *Biological oceanographers* (marine biologists) study plant and animal life in the ocean. They search for ways to extract drugs from seaweeds or sponges, investigate life processes of marine animals, and determine the effects of radioactivity and pollution on the growth of fish. *Physical oceanographers* (physicists and geophysicists) study the physical properties of the ocean. Their research on the relationships between the sea and the atmosphere may lead to control over the weather. *Geological oceanographers* (marine geologists) study the ocean's mountain ranges, rocks, and sediments. Locating deposits of minerals, oil, and gas on the ocean floor is an application of their work. *Chemical oceanographers* investigate the chemical composition of ocean water and sediments as well as chemical reactions in the sea. One practical area of their study is the removal of salt from sea water. *Oceanographic engineers* and *electronic specialists* design and build instruments for oceanographic research and operations. They also lay cables, supervise underwater construction, and locate sunken ships to recover their cargos.



Oceanographers get ready to lower test instrumen.

Almost two of every three oceanographers perform or administer research and development activities. Many teach in colleges and universities. A few are engaged in technical writing, in consulting, and in administering activities other than research.

Places of Employment

About 4,500 people—about 5 percent of them women—worked as oceanographers in 1972. About one-third worked in colleges and universities, one-third in private industry, and one-fourth for the Federal Government. Federal agen-

cies employing substantial numbers of oceanographers include the Naval Oceanographic Office, and the National Oceanic and Atmospheric Administration (NOAA). Some oceanographers work for firms designing and developing instruments and vehicles for oceanographic research. A few work for fishery laboratories of State and local governments.

Training, Other Qualifications, and Advancement

The minimum requirement for beginning professional jobs in oceanography is a bachelor's degree with a major in oceanography, biology, earth or physical sciences, mathematics, or engineering. Professional jobs in research, teaching, and high-level positions in most other types of work require graduate training in oceanography or a basic science.

Only 46 colleges and universities offered undergraduate degrees in oceanography or marine sciences in 1972. However, since oceanography is an interdisciplinary science, training in a basic science and a strong interest in oceanography may be adequate preparation for some beginning jobs or for entry to graduate school.

Important college courses for oceanographers include mathematics, physics, chemistry, geophysics, geology, meteorology and biology. In general, students should specialize in the particular science that is closest to their area of oceanographic interest. For example, students interested in chemical oceanography could obtain a degree in chemistry.

In 1972 about 85 colleges offered advanced degrees in oceanography and marine sciences. In graduate schools, students take advanced courses in oceanography and in a basic science.

Graduate students usually work part of the time aboard ship, doing oceanographic research and becoming familiar with the sea and with techniques used to obtain oceanographic information. Universities at the various stations along our coasts offer summer courses for both graduates and undergraduate students, which are especially beneficial for students from inland universities. Oceanographers should have the curiosity needed to do new research and the patience to collect data and conduct experiments.

Beginning oceanographers with the bachelor's degree usually start as research or laboratory assistants, or in jobs involving routine data collection, analysis, or computations. Most beginning oceanographers receive on-the-job training related to the specific work at hand. The extent of the training varies with the background and needs of the individual.

Experienced oceanographers may direct surveys and research programs or advance to administrative or supervisory jobs in research laboratories.

Employment Outlook

Job opportunities for oceanographers with a Ph.D. are expected to be favorable through the mid-1980's, especially for those who specialize in ocean engineering. People with less education may face competition for beginning jobs and find other opportunities limited to doing routine analytical work as research assistants.

In addition to openings from the rapid growth expected in this field, some oceanographers will be needed each year to replace those who die, retire, or transfer to other fields.

Growing recognition of the importance of the oceans to the Nation's welfare and security has heightened interest in oceanography and has opened new fields for specialists. More oceanographers will be needed to improve methods of taking foods and drugs from the oceans, manage fisheries, and develop economical means to harness the ocean for energy and provide fresh water from the sea. Some will be needed to develop new technologies for discovering and mining the fuel and mineral resources of the ocean's floor and to protect water from pollution and shoreline from damage by waves and tides. Still others will be needed for weather and iceberg forecasting and to study air-sea interaction for long-range weather forecasts. The Federal Government finances most oceanographic research and development; employment opportunities could be affected by changes in Federal spending priorities.

In the years ahead, improving the Nation's defenses against submarines and surface vessels will require oceanographic research into underwater sound, surface and subsurface currents, and the shape of the ocean floor. New super tankers will require the building of new large ports and will create jobs for oceanographers who specialize in ocean engineering.

Teaching opportunities in colleges and universities may expand as interest in oceanography grows.

Earnings and Working Conditions

Oceanographers have relatively high earnings; average salaries were about twice the average received by nonsupervisory workers in private industry, except farming.

In early 1973, oceanographers in the Federal Government with the bachelor's degree received starting salaries of $7,619 or $9,520 a

year, depending on their college grades. Those with the master's degree could start at $11,614 or $13,996; and those with the Ph.D. degree at $13,996 or $16,682.

In private industry in 1972, new graduates with the bachelor's degree received average starting salaries of $9,000 a year, according to the American Geological Institute. Those with the master's degree could start at $11,000; and those with the Ph.D. at $13,000.

Beginning oceanographers in educational institutions generally receive the same salaries as other faculty members. (See statement on College and University Teachers elsewhere in the *Handbook*.) In addition to regular salaries, many experienced oceanographers earn extra income from consulting, lecturing, and writing.

Oceanographers engaged in research that requires sea voyages are frequently away from home for weeks or months at a time. Sometimes they live and work in cramped quarters. People who like the sea, however, may find these voyages satisfying.

Sources of Additional Information

For information about careers in oceanography and about colleges and universities that offer training in marine science, contact:

National Oceanic and Atmospheric Administration, 6001 Executive Boulevard, Rockville, Maryland 20852. Attention: AD 411

Federal Government career information is available from any regional office of the U.S. Civil Service Commission or from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E. Street, NW., Washington, D.C. 20390.

The booklet, *Training and Careers in Marine Science*, is available for 50 cents from:

International Oceanographic Foundation, 10 Rickenbacker Causeway, Virginia Key, Miami, Fla. 33149.

A booklet, *Oceanography Information Sources '73*, lists the names and addresses of industrial organizations involved in oceanography and publishers of oceanographic educational materials, journals, and periodicals. Copies may be purchased for $2.50 from:

Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave., NW., Washington, D.C. 20418.

Some information on Oceanographic specialities is available from professional societies listed elsewhere in the *Handbook*. (See statements on Geologists, Geophysicists, Life Scientists, Meteorologists, and Chemists elsewhere in the *Handbook*.)

LIFE SCIENCE OCCUPATIONS

Life scientists study living organisms and their life processes. They are concerned with the origin and preservation of life, from the largest animal to the smallest living cell. The number and variety of plants and animals are so vast, and their processes so varied and complex, that life scientists usually work in one of the three broad areas—agriculture, biology, or medicine.

Life scientists perform research to expand knowledge, teach, or apply scientific theories to the solution of practical problems. New drugs, special varieties of plants, and a cleaner environment can result from the work of life scientists.

This chapter discusses life scientists as a group, since they receive comparable basic training and have roughly similar employment and earning prospects. Brief descriptions are provided about the nature of the work of a number of life scientists—including botanists, zoologists, and microbiologists. This section also contains separate statements on biochemists and soil scientists.

BIOCHEMISTS

(D.O.T. 041.081)

Nature of the Work

Biochemists play an important role in the search for the basis of life and what sustains it. Their professional interests range from determining the effects of heredity on life processes to learning how living things react to space travel.

Biochemists study the chemical composition of organisms and the changes caused by genetic and environmental factors. They analyze the chemical processes related to biological functions, such as muscular contraction, reproduction, and metabolism. Biochemists also investigate the effects on organisms of substances such as foods, hormones, and drugs.

The methods and techniques of biochemistry are applied to areas such as medicine or agriculture. For instance, biochemists may develop diagnostic procedures or find cures for diseases or identify the nutrients necessary to maintain good health. To improve agricultural harvests they may develop pest-control agents or fertilizers.

Biochemists determine how living things react to space travel.

More than 3 out of 4 biochemists work in basic and applied research activities. The distinction between basic and applied research is often one of degree and biochemists may do both types. Most, however, are in basic research. The few doing strictly applied research use the results of basic research for practical uses. For example, the knowledge of how an organism forms a hormone is used to develop a process for synthesizing the hormone and producing it on a mass scale.

Laboratory research involves weighing, filtering, distilling, drying, and culturing (growing microorganisms) ingredients. Some experiments also require sophisticated tasks such as designing and constructing chemical apparatus or performing tests using radioactive tracers. Biochemists use a variety of instruments including electron microscopes, and may devise new instruments and techniques as needed. They usually report the results of their research in scientific journals or before scientific groups.

Some biochemists combine research with teaching in colleges and universities. A few work in industrial production and testing activities.

Places of Employment

About 12,500 biochemists were employed in the United States in 1972. Although the exact number of women working in the profession is not known, nearly one-fourth of those receiving advanced degrees in biochemistry in recent years have been women.

More than half of all biochemists are employed in colleges and universities, and most do basic and applied research and development in university-operated laboratories and hospitals. Nonprofit research

institutes and foundations employ some biochemists. Many biochemists work in private industry, primarily in companies manufacturing drugs, insecticides, and cosmetics. Biochemists also work in Federal, State, and local government agencies. Most do research for Federal agencies concerned with health and agricultural problems. A few are self-employed consultants to industry and government.

Training, Other Qualifications, and Advancement

The minimum educational requirement for many beginning jobs as a professional biochemist, especially in research or teaching, is an advanced degree. Graduate training is necessary for advancement to many management or administrative jobs. A bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry, may qualify some persons for entry jobs as research assistants or technicians.

More than 40 schools award the bachelor's degree in biochemistry, and nearly all colleges and universities offer a major in biology or chemistry. Regardless of their college major, future biochemists should take undergraduate courses in chemistry, biology, biochemistry, mathematics, and physics.

About 200 colleges and universities offer graduate degrees in biochemistry. Graduate students generally are required to have a bachelor's degree in biochemistry, biology, or chemistry. These students take advanced courses in biochemistry or a specialty of the field. For example, a university affiliated with a medical school or hospital may have facilities to study the biochemistry of diseases. Therefore, students wishing to specialize should select their schools carefully. Graduate training requires actual research in addition to advanced science courses. For the doctoral degree, the student specializes in one field of biochemistry by doing intensive research and writing a thesis.

Young people planning careers as biochemists should be able to work independently or as part of a team. Precision, keen powers of observation, and mechanical aptitude also are important. Biochemists should have analytical abilities and curious minds, as well as the patience and perseverance needed to complete the hundreds of experiments that may be necessary to solve one problem.

Graduates with advanced degrees may begin their careers as teachers or researchers in colleges or universities. In private industry, most begin in research jobs and with experience may advance to administrative positions.

New graduates with a bachelor's degree usually start work as research assistants or technicians. These jobs in private industry often involve testing and analysis. In the drug industry, for example, research assistants analyze the ingredients of a product to verify and maintain its purity or quality.

Employment Outlook

Job opportunities for biochemists with advanced degrees should be favorable through the mid-1980's. In addition to opportunities resulting from the rapid growth expected in this field, hundreds of openings will become available each year to replace those who die, retire, or transfer to other occupations.

Increased research and development expenditures in the life sciences, primarily by the Federal Government, are major factors contributing to the anticipated growth in this field. For example, the great urgency to find cures for cancer, heart disease, muscular dystrophy, and other illnesses should stimulate requirements for biochemists. Additional biochemists will find jobs in hospitals and health centers using automated biochemical tests for diagnoses. An increasing number also will be needed to implement stricter drug standards established by Federal regulatory agencies. Biochemistry also is important in other areas of public concern such as environmental protection.

Growing college enrollments in chemistry and the life sciences will add to the demand for biochemists to teach in colleges and universities.

Earnings and Working Conditions

Biochemists have relatively high salaries; average earnings were about twice the average received by all nonsupervisory workers in private industry, except farming. According to a 1972 survey of the American Chemical Society, salaries for biochemists with 2 to 4 years of experienced averaged $8,800 for those with a bachelor's degree; $10,800 for those with a master's degree; and $12,500 for those with a Ph.D. Biochemists also can look forward to higher salaries as they gain experience. Those who had 10 to 14 years of experience averaged $13,500 with a bachelor's degree, $15,000 with a master's degree, and $19,200 with a Ph.D. degree.

Starting salaries paid to biochemists employed by colleges and universities are comparable to those for other professional faculty members. Biochemists in educational institutions often supplement their incomes by engaging in outside research or consulting work.

Sources of Additional Information

General information on careers in biochemistry may be obtained from:

American Society of Biological Chemists, 9650 Rockville Pike, Bethesda, Md. 20014.

LIFE SCIENTISTS

(D.O.T. 040.081, 041.081, 041.168, 041.181, 041.281)

Nature of the Work

Life scientists study all aspects of living organisms, emphasizing the relationship between animals, plants, and microorganisms, and their environments.

Almost two-fifths of all life scientists are in research and development. Many work in laboratories conducting basic research aimed at adding to our knowledge of living organisms. Knowledge gained from this research frequently is applied to—and has resulted in the development of—insecticides, disease-resistant crops, and medicines. When working in laboratories, life scientists must be familiar with research techniques and complex laboratory equipment such as electron microscopes. Knowledge of computers also is useful in conducting some experiments. Not all research, however, is performed in laboratories. For example, a botanist who explores the volcanic Alaskan valleys, to see what plants grow there, also is doing research.

Teaching in a college or university is the major area of work for more than one-fourth of all life scientists, many of whom also do independent research. Another fourth are in some type of management and administrative work that ranges from planning and administering programs for testing foods and drugs to directing activities at zoos or botanical gardens. Some life scientists work as consultants to business firms or government in their specialty areas. Others write for technical publications or test and inspect foods, drugs, and other products. Some work in technical sales and services jobs for industrial companies where, for example, they demonstrate the proper use of new chemicals or technical products.

Scientists working in many areas of the life sciences often call themselves *biologists*. However, the majority are classified by the type of organism they study or by the specific activity performed.

Life scientists dealing primarily with plants are *botanists*. Some study all aspects of plant life, while others work in defined areas such as identifying and classifying plants or studying the structure of plants and plant cells. Some botanists concentrate on the cause and cure of plant diseases.

Some life scientists are concerned with the mass development of plants. For example, *agronomists* improve the quality and yield of crops by developing new growth methods or by controlling disease, pests, and weeds. They also analyze soils to determine ways of increasing acreage yields and decreasing soil erosion. *Horticulturists* work with orchard and garden plants such as fruits, nuts, vegetables, and flowers. They develop new or improved plant varieties, and better methods of growing, harvesting, and transporting crops.

Life scientists must be familiar with fundamental research techniques.

Zoologists concentrate on animal life—its origin, behavior, and life processes. Some conduct experimental studies with live animals and others examine dissected animals in laboratories. Zoologists are usually identified by the animal group studied—ornithologists (birds), herpetologists (reptiles and amphibians), and mammalogists (mammals).

Animal husbandry specialists do research on the breeding, feeding, and diseases of domestic farm animals. *Veterinarians* study diseases and abnormal functioning in animals. (See statement on Veterinarians elsewhere in the *Handbook*.)

Life scientists who investigate the growth and characteristics of microscopic organisms such as bacteria, viruses, and molds are called *microbiologists*. They isolate organisms and make cultures for close examination under a microscope. *Medical microbiologists* are concerned with problems such as the relationship between bacteria and disease or the effect of antibiotics on bacteria. Others specialize in soil bacteriology (effect of microorganisms on soil fertility), virology (viruses), or immunology (mechanisms that fight infections).

Anatomists study the composition of organisms, from cell structure to the formation of tissues and organs. Many specialize in human anatomy. Examination may entail dissections or involve the use of electron microscopes for organisms of submicroscopic size.

Some life scientists apply their specialized knowledge across different areas, and may be classified by the functions performed. *Ecologists*, for example, study the mutual relationship among organisms and their environments. They are interested in the effects of environmental influences such as rainfall, temperature, and altitude on organisms. For example, ecologists extract samples of phytoplankton (microscopic plants that produce oxygen) from bodies of water to determine the effects of pollution, and measure the radioactive content of fish by tracing tagged elements as they pass through their systems.

Embryologists study the development of an organism from a fertilized egg through the hatching process or gestation period. They investigate the cause of healthy and abnormal development in organisms.

Nutritionists examine the bodily processes through which food is utilized and transformed into energy. They learn how vitamins, minerals, proteins, and other nutrients build and repair tissues.

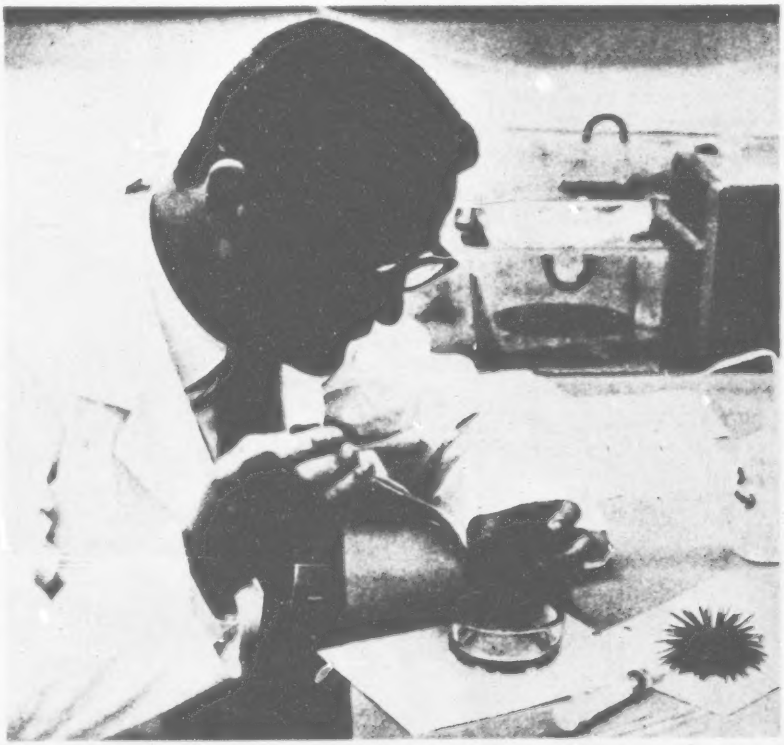
Pharmacologists conduct tests on animals such as rats, guinea pigs, and monkeys to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs. They may develop new or improved chemical compounds for use in drugs and medicines.

Pathologists specialize in the effects of diseases, parasites, and insects on human cells, tissues, and organs. Others may investigate genetic variations caused by drugs.

Biochemists and Biological Oceanographers, which are also life scientists, are included in separate statements elsewhere in the *Handbook*.

Places of Employment

More than 180,000 persons worked as life scientists in 1972. Almost 55,000 worked as agricultural scientists, about 75,000 as biological scientists, and more than 55,000



Life scientist induces sea urchin to shed "eggs" for experiment in outer space.

worked on problems related to medical science. Over one-third of all biologists and about eight percent of all agricultural scientists are women.

Colleges and universities employ nearly three-fifths of all life scientists in both teaching and research jobs. Medical schools and hospitals also employ large numbers of medical investigators. Sizable numbers of agronomists, horticulturists, animal husbandry specialists, entomologists, and other agriculture-related specialists work for State agricultural colleges and agricultural experiment stations.

More than half of the 26,000 life scientists working for the Federal Government in 1972 were in the Department of Agriculture. The Department of the Interior employs most of the fish and wildlife biologists working for the Federal Government. Other large numbers of life scientists work for the Department of the Army and the National Institutes of Health. State and local governments combined employ 9,000 biologists—mostly fish and wildlife specialists, microbiologists, and entomologists—to detect and control diseases and to work in conservation.

Approximately 25,000 life scientists work in private industry, mostly in pharmaceuticals, industrial chemicals, and food processing industries. A few are self-employed and more than 4,000 work for nonprofit research organizations and foundations.

More than one-third of all life scientists live in six States—California, New York, Illinois, Pennsylvania, Florida, and Maryland.

Training, Other Qualifications, and Advancement

Young people seeking a career in the life sciences should plan to obtain an advanced degree, preferably a Ph.D., in their field of interest. The Ph.D. degree generally is required for college teaching and for independent research. It is also necessary for many jobs administering research programs. New graduates who have master's degrees may qualify for some beginning jobs in applied research and college teaching.

The bachelor's degree may be adequate preparation for some beginning jobs, but promotions often are limited to intermediate level positions. New graduates with a bachelor's degree can start their careers in testing and inspecting jobs, or become technical sales and service representatives. They also may become advanced technicians, particularly in medical research or, with courses in education, a high school biology teacher. (See statement on Secondary School Teachers elsewhere in the *Handbook*.)

Most colleges and universities offer life science curriculums. However, courses differ from one college to another. For example, liberal arts colleges and universities emphasize the biological sciences and medical research. The agricultural sciences are stressed at State universities and land-grant colleges because of the opportunities for training and research provided by agricultural experiment stations.

Young people seeking careers in the life sciences should obtain the broadest possible undergraduate background in biology and other sciences. Courses taken should include biochemistry, organic and inorganic chemistry, physics, and mathematics. Statistics, calculus, biometrics, and computer programming courses also are useful.

Large numbers of colleges and universities confer advanced degrees in the life sciences. Requirements for advanced degrees usually include field work and laboratory research, as well as classroom studies and preparation of a thesis.

Young people planning careers as life scientists should be able to work independently, or as part of a team. Physical stamina and an inquiring mind are necessary for those interested in research in remote places. Life scientists must be able to express ideas both orally and in writing.

Life scientists who have advanced degrees usually begin in research or teaching jobs. With experience, they may advance to jobs such as supervising research programs, or become full professors in colleges and universities.

Employment Outlook

Employment in the life sciences is expected to increase rapidly through the mid-1980's. Thousands of jobs for life scientists will open because of this growth and the need to replace those who transfer to other fields of work, die, or retire. Nevertheless, new graduates may face competition since the number of life science graduates may grow more rapidly than employment opportunities. Under these conditions, those holding advanced degrees, especially the Ph.D., should face less competition for jobs than those who have bachelor's degrees. Opportunities for those with only an undergraduate degree may be limited to research assistant or technician jobs.

Continued growth in research and development, particularly medical research programs sponsored by the Federal Government and voluntary health agencies, is a major reason for the expected increase in the employment of life scientists. For example, the Feder-

Life scientists conduct experimental studies with animals.

al Government is expected to allocate substantial expenditures for cancer research during the next few years. Other areas of concentrated medical study include heart disease and birth defects. Research in such relatively new areas as space biology, radiation biology, environmental health, and genetic regulation will probably increase also. In addition, industry is expected to increase its research and development spending in the biological sciences.

Stringent Federal health regulations are likely to require additional life scientists in industry to test new drugs, chemicals, or foods, and to change processing methods.

The large college and university enrollments expected in the life sciences through the mid-1980's should increase the demand for Ph.D.'s as teachers. It also should result in openings for qualified persons with master's degrees, especially in community colleges.

Earnings and Working Conditions

Agricultural and biological scientists both command relatively high salaries. Their average earnings are more than twice those received by nonsupervisory workers in private industry, except farming.

In the Federal Government in early 1973, life scientists having a bachelor's degree could begin at $7,694 or $9,520 a year, depending on their college records. Beginning life scientists having the master's degree could start at $9,520 or $11,614, depending on their academic records or previous work experience. Those having the Ph.D. degree could begin at $13,996 or $16,682.

Salaries for 9 months of teaching in 4-year colleges averaged about $9,300 for instructors, and $11,500 for assistant professors. More experienced personnel earned between $14,000 (associate professors) and $18,000 (professors) a year. (See statement on College and University Teachers.) Life scientists in educational institutions sometimes supplement their regular salaries with income from writing, consulting, and special research projects.

Beginning salary offers in 1972 for agricultural scientists averaged approximately $8,300 a year for those having bachelor's degrees, and $10,600 for those having a graduate degree. According to the College Placement Council, agricultural scientists averaged $8,700 a year to start in the chemical industry, the largest employer of life scientists in private industry. Another large employer of life scientists, the food industry, paid agricultural scientists beginning salaries of $8,500 in 1972.

During 1972, life scientists in research and development in all sectors earned average monthly salaries of $1,023 at the bachelor's degree level, $1,215 at the master's level, and $1,533 at the Ph.D. level, according to one national survey.

Most life scientists work in well-lighted, well-ventilated, and clean laboratories. Some jobs require working outdoors under extreme weather conditions and doing strenuous physical work for long periods of time. Some jobs require living in remote areas without modern conveniences

Sources of Additional Information

General information on careers in the life sciences is available from:

American Institute of Biological Sciences, 3900 Wisconsin Ave., NW., Washington, D.C. 20016.

American Society of Horticultural Science, 914 Main St., P.O. Box 109, St. Joseph, Mich. 49085.

American Physiological Society, Department of Botany, University of North Carolina, Chapel Hill, N.C. 27514.

Ecological Society of America, Department of Botany, University of North Carolina, Chapel Hill, N.C. 27514.

Special information on Federal Government careers is available from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St., NW., Washington, D.C. 20415.

SOIL SCIENTISTS

(D.O.T. 040.081)

Nature of the Work

Soil scientists study the physical, chemical, and biological characteristics and behavior of soils. They investigate the soils both in the field and in the laboratory and grade them according to a national system of soil classification. From their research, scientists can classify soil in order to respond to management questions concerning its capability to produce crops, grasses, and trees, and concerning the soil's engineering utility in relation to foundations for buildings and other structures. Soil scientists prepare maps, usually based on aerial photographs, on which they plot the individual kinds of soil and other landscape features significant to soil use and management in relation to land ownership lines, field boundaries, roads, and other conspicuous features.

Soil scientists also conduct research to determine the physical and chemical properties of soils in order to understand their behavior and origin. They predict the yields of cultivated crops, grasses, and trees, under alternative combinations of management practices.

Soils science offers opportunities for those who wish to specialize in soil classification and mapping, soil geography, soil chemistry, soil physics, soil microbiology, and soil management. Training and experience in soil science also will prepare persons for positions as farm managers, land appraisers, and many other professional positions.

Places of Employment

An estimated 5,000 soil scientists were employed in 1972. Most soil scientists are employed by agencies of the Federal Government, State equipment stations, and colleges of agriculture. However, many are employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State highway departments, State conservation departments, and farm management agencies. A few are independent consultants, and others work for consulting firms. An increasing number are employed in foreign countries as research leaders, consultants, and agricultural managers.

Training and Advancement

Training in a college or university of recognized standing is important in obtaining employment as a soil scientist. For Federal employment, the minimum qualification for entrance is a B.S. degree with a major in Soil Science or in a closely related field of study, and with 30 semester hours of course work in the biological, physical, and earth sciences, including a minimum of 15 semester hours in soils. Those having graduate training—especially those with the doctorate—can be expected to advance rapidly into a responsible and high-paying position. This is particularly true in soil research, including the more responsible positions in soil classification and in teaching. Soil scientists who are qualified for work with both field and laboratory data have a special advantage.

Soil scientists test soils in the laboratory.

Many colleges and universities offer fellowships and assistantships for graduate training, or employ graduate students for part-time teaching or research.

Employment Outlook

The demand is increasing for soil scientists to help complete the scientific classification and evaluation of the soil resources in the United States. One of the major

program objectives of the Soil Conservation Service of the U.S. Department of Agriculture is to complete the soil survey of all rural lands in the United States.

This program includes research, soil classification, interpretation of results for use by agriculturists and engineers, and training of other workers to use these results. Also, demand is increasing for both basic and applied research to increase the efficiency of soil use.

Earnings

The incomes of soil scientists depend upon their education, professional experience, and individual abilities. The entrance salary in the Federal service for graduates having a B.S. degree was $7,694 in early 1973. They may expect advancement to $9,520 after 1 year of satisfactory performance. Further promotion depends upon the individual's ability to do high-quality work and to accept responsibility. Earnings of well-qualified Federal soil scientists with several years experience range from $13,996 to $23,088 a year.

Sources of Additional Information

Additional information may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

See also statements on Chemists and Life Scientists.

MATHEMATICS OCCUPATIONS

Mathematics is both a science and a tool essential for many kinds of work. As a tool, mathematics is necessary to understanding and expressing ideas in science, engineering, and, increasingly, in human affairs. The application of mathematical techniques in these fields has increased greatly because of the widespread use of computers, which enable mathematicians to do complex problems rapidly and efficiently. As a result, employment opportunities for persons trained in mathematics have expanded rapidly in recent years.

Young people considering careers in mathematics should be able to concentrate for long periods of time. They should enjoy working independently with ideas and solving problems, and must be able to present their findings in written reports.

This section describes two occupations—mathematician and statistician. A statement on actuaries, a closely related mathematical occupation, is discussed in the section on Insurance Occupations. Entrance into any of these fields requires college training in mathematics. For many types of work, graduate education is necessary.

Many other workers in the natural and social sciences and in data processing use mathematics extensively, although they are not primarily mathematicians. These occupations are discussed elsewhere n the *Handbook*, as are jobs for high school mathematics teachers, covered in the statement on Secondary School Teachers.

MATHEMATICIANS

(D.O.T. 020.088)

Nature of the Work

Mathematics, one of the oldest and most basic sciences, is also one of the most rapidly growing professions. Mathematicians today are engaged in a wide variety of activities, ranging from the creation of new theories to the translation of scientific and managerial problems into mathematical terms.

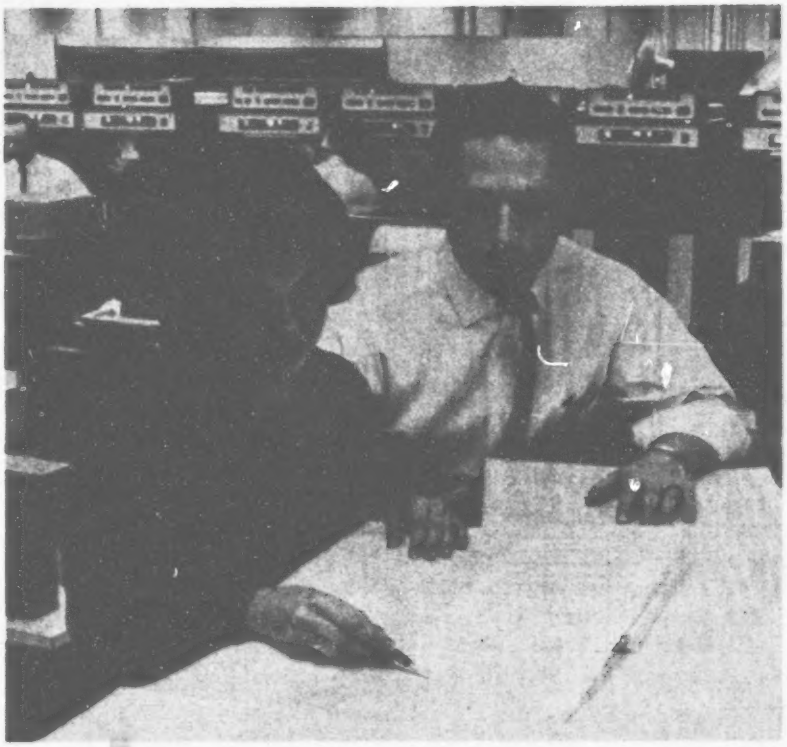
There are two broad classes of mathematical work: pure or theoretical mathematics; and applied mathematics, which includes solving numerical problems. Theoretical mathematicians further mathematical science by discovering new principles and new relationships between existing principles of mathematics. They seek to increase basic knowledge without necessarily considering its practical use. Yet, this pure and abstract knowledge has been instrumental in many scientific and engineering achievements. For example, in 1854 Bernard Riemann invented a seemingly impractical non-Euclidian geometry that became part of the theory of relativity developed by Albert Einstein more than a half-century later.

Mathematicians in applied work develop theories, techniques, and approaches to solve problems in natural science, social science, management, and engineering. They analyze how problems can be expressed in mathematical terms, and use mathematics to help solve these problems. Their work ranges from the analysis of vibrations and the stability of rockets to studies of the effects of new drugs on disease. Some applied mathematicians, in the field of operations research for example, study problems ranging from finding the way to make the largest profit with the least risk in managing a business, to the timing of traffic lights for optimum use in our highway systems.

Some mathematicians (or mathematical statisticians—as they are often called) use mathematical theory to design and improve statistical methods for collecting and analyzing numerical information, and estimating unknown quantities. They develop statistical tools and frequently work with statisticians to plan and design surveys in fields such as agriculture, biology, economics, psychology, sociology, and industrial quality control.

In applied mathematics, mathematical knowledge and modern computing equipment are used to get numerical answers to specific problems. Some work in this area requires a very high level of mathematical knowledge, skill, and ingenuity. However, much of this work may require training somewhat different from that of the mathematician. (See statements on Programers and Systems Analysts elsewhere in the *Handbook*.

Almost one-fourth of all mathematicians work in research and development, extending basic knowledge and finding new uses for existing knowledge. Nearly one-third are primarily college teachers, many of whom do some research. A little less than one-third are in management and administration—about two-fifths of whom manage and administer research and development programs. Most of the remainder are concerned chiefly with operations research or production



Mathematicians use modern computing equipment.

and inspection (quality control) of manufactured products.

Places of Employment

About 76,000 persons worked as mathematicians in 1972; almost 15 percent were women. More than one-half worked in private industry, primarily in independent research and development firms, and in the ordnance, aircraft, machinery, and electrical equipment industries. Other mathematicians were employed as consultants.

More than one-third of all mathematicians worked for colleges and universities. Some of these persons are teachers, others work mainly in research and development and have few or no teaching duties. Others worked for the Federal Government, primarily in the Department of Defense. A few worked for nonprofit organizations and State and local governments.

Mathematicians work in all States, but are concentrated in those with large industrial areas and large college and university enrollments. Nearly half of the total were in seven States—California, New York, Massachusetts, Pennsylvania, Illinois, Maryland, and New Jersey. One-fifth live in three metropolitan areas—New York; Washington, D.C.; and Los Angeles-Long Beach.

Training, Other Qualifications, and Advancement

The minimum educational requirement for a beginning job in mathematics outside of college teaching is the bachelor's degree with a major in mathematics, or with a major in an applied field—such as physics or engineering—and a minor in mathematics. For many beginning jobs, particularly in research or college teaching, an advanced degree is required. Graduate study is also valuable for advancement to more responsible positions in all types of work.

The bachelor's degree in mathematics is offered by most colleges and universities throughout the country. Mathematics courses usually required for a degree are analytical geometry, calculus, differential equations, probability and statistics, mathematical analysis, and modern algebra. A person planning to study this field in college should take as many mathematics courses as possible while still in high school.

More than 350 colleges and universities have programs leading to the master's degree in mathematics; about 150 also offer the Ph.D. In graduate school, students build upon the basic knowledge acquired in earlier studies. They usually concentrate on a specific field of mathematics, such as algebra, mathematical analysis, or statistics, by conducting intensive research and taking advanced courses.

The bachelor's degree is adequate preparation for many positions in private industry and the Federal Government, particularly those connected with computer work. Some new graduates having the bachelor's degree assist senior mathematicians by performing computations and solving less advanced mathematical problems in applied research. Others work as graduate research or teaching assistants in colleges and universities while working toward an advanced degree.

Advanced degrees are required for an increasing number of jobs in industry and government—in research and in many areas of applied mathematics. The Ph.D. degree is necessary for full faculty status at most colleges and universities, as well as for advanced research positions.

For work in applied mathematics, training in the field in which the mathematics will be used is very important. Fields in which applied mathematics is used extensively include physics, engineering, and operations research; other fields are business and industrial management, economics, statistics, chemistry and life sciences, and the behavioral sciences. Training in numerical analysis and programming is especially desirable for mathematicians working with computers.

Mathematicians need good reasoning ability, persistence, and the ability to apply basic principles to new types of problems. They must be able to communicate well with others since they often must listen to a non-mathematician describe a problem in general terms, and check and recheck to make sure they understand the mathematical solution that is needed.

Employment Outlook

Persons seeking beginning jobs as mathematicians are likely to face competition through the mid-1980's. Employment of mathematicians is expected to increase rapidly in this period, and several thousand mathematicians will be needed each year to replace those who die, retire, or transfer to other occupations. However, the number of persons trained in mathematics and looking for jobs in the field is likely to increase even more rapidly.

Those with the Ph.D. degree may have less difficulty finding jobs than persons with less education, but they may face competition for entry level jobs, especially in college and university teaching. Many graduates with the Ph.D. look for jobs with colleges and universities where there will be increasing numbers of students taking mathematics courses. However, some may have to accept jobs that do not fully utilize their training, especially those who have specialized in pure or theoretical mathematics.

There is a need for more mathematicians to solve an increasingly wide variety of complex research and development problems. In engineering, for example, applications of mathematical techniques and principles will be needed in the design of equipment, from simple devices to airplanes, ships, and missiles, in order to get the most reliable performance for the least cost. In addition, mathematicians will be increasingly needed in research in the natural and social sciences, military sciences, operations research, and business management. This work requires both a high degree of mathematical competence and a knowledge of the field of specialization. Expenditures to support these research and development activities increased steadily through most of the 1960's, and then fell slightly in the early 1970's; they are expected to rise again through the mid-1980's, although more slowly than in the past.

College graduates with degrees in mathematics will be able to find jobs in many other fields, because the education necessary for a degree in mathematics is also an excellent background for other jobs that rely heavily on the application of mathematical theories and methods. Thus, many mathematics majors may find jobs in high school teaching, statistics, actuarial work, computer programming, systems analysis, economics, engineering, physical science, and life science. Employment opportunities in these related fields will probably be best for those who combine a major in mathematics with a minor in one of these subjects.

Earnings and Working Conditions

In 1972, mathematicians earned average salaries over twice as high as the average for nonsupervisory workers in private industry, except farming. Starting salaries for mathematicians and mathematical statisticians averaged $9,500 a year according to the limited data available. Those with a master's degree could start at about $11,000 annually. Yearly salaries for new graduates having the Ph.D., most of whom had some experience, averaged over $16,000.

In the Federal Government in early 1973, mathematicians having the bachelor's degree and no experience could start at either $7,694 or $9,520 a year, depending on their college records. Those with the master's degree could start at $11,614 or $13,996; and persons having the Ph.D. degree could begin at either $13,996 or $16,682.

Salaries paid to college and university teachers vary greatly depending both on the quality and location of the school and the ability and experience of the individual. According to the American Mathematical Society, college and university teachers earned from as low as $8,000 a year (instructors) to $25,000 a year (professors). Some were paid over $30,000 annually.

Mathematicians in colleges and universities often supplement their regular salaries with income from summer teaching, special research projects, consulting, and writing.

Sources of Additional Information

There are several brochures that give facts about the field of mathematics, including career opportunities, professional training, and colleges and universities with degree programs.

Professional Training in Mathematics is available for 25¢ from:

American Mathematical Society, P.O. Box 6248, Providence, R.I. 02904.

Professional Opportunities in Mathematics (35¢) and *Guide Book to Departments in the Mathematical Sciences* ($1.35) are provided by:

Mathematical Association of America 1225 Connecticut Ave. NW., Washington, D.C. 20036.

For specific information on careers in applied mathematics and electronic computer work, contact:

Association for Computing Machinery 1133 Avenue of the Americas, New York, N.Y. 10036.

Society for Industrial and Applied Mathematics, 33 S. 17th St., Philadelphia, Pa. 19103.

Facts on careers in mathematical statistics are available from:

Institute of Mathematical Statistics Department of Statistics, California State College at Hayward, Hayward, Cal. 94542.

For Federal Government career information, contact any regional office of the U.S. Civil Service Commission, or:

Interagency Board of U.S. Civil Service Examiners, 1900 E St. NW., Washington, D.C. 20415.

Other sections of the *Handbook* discuss related occupations, such as statisticians, actuaries, programmers, and systems analysts.

STATISTICIANS

(D.O.T. 020.188)

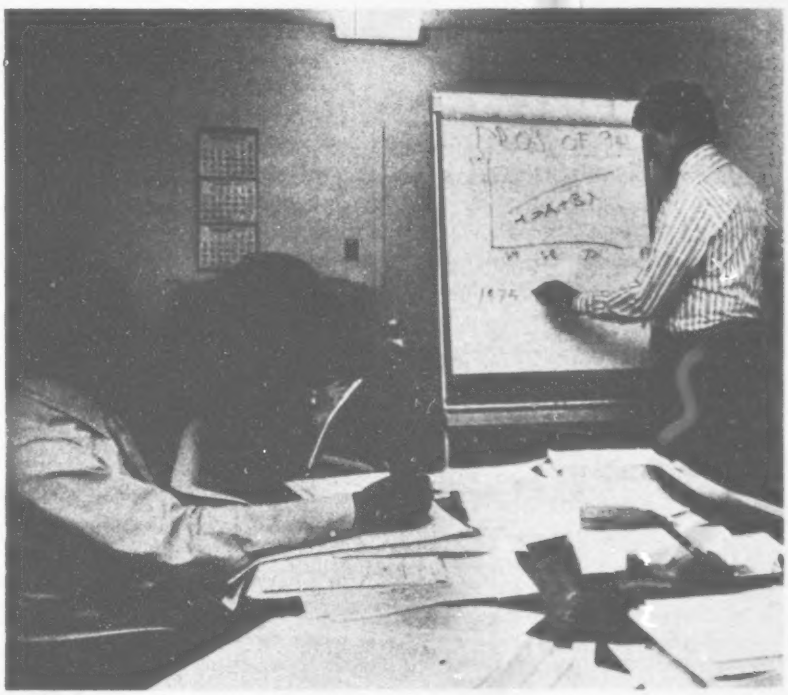
Nature of the Work

Statistics are numbers that help describe the characteristics of the world and its inhabitants. Statisticians collect, analyze, and interpret numerical data based on their knowledge of statistical methods and of a particular subject, such as economics, human behavior, or engineering. They may use statistical techniques to predict population growth or economic conditions, develop quality control tests for manufactured products, or help business managers and government officials make decisions and evaluate the results of new programs.

Many statisticians plan surveys, design experiments, or analyze data. For most surveys, the statistician must select a sample; for example, television rating services ask only a few thousand families, rather than all viewers, what programs they watch. Statisticians decide where to get the data, determine the type and size of the sample group, and develop the survey questionnaire or reporting form. They also prepare the instructions for workers who will tabulate the returns. Statisticians who design experiments prepare mathematical models to test a particular theory. Those in analytical work interpret collected data and summarize their findings in tables, charts, and written reports.

Some statisticians direct statistical programs. A few combine research with teaching. The rest work in quality control, operations research, production and sales forecasting, and market research.

Because statistics has such a



Statisticians use statistical techniques to predict economic conditions.

wide use, it is sometimes difficult to distinguish statisticians from specialists in other fields who use statistics. For example, a statistician working with data on economic conditions may have the title of economist. Statisticians sometimes work closely with mathematicians and mathematical statisticians. (See statement on mathematicians elsewhere in this section.)

Places of Employment

Approximately 23,000 persons—over one-third of them women—worked as statisticians in 1972. About 2 out of 3 statisticians are in private industry, primarily in manufacturing, public utility, finance, and insurance companies. More than one-fifth worked for the Federal Government, primarily in the Departments of Commerce; Agriculture; Defense; and Health, Education, and Welfare. Others worked in State and local government or colleges and universities.

Although statisticians work in all States, most are in metropolitan areas, and about one-fourth lived in three areas—New York; Washington, D.C.; and Los Angeles-Long Beach.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning jobs in statistics. For other beginning statistical jobs, however, a bachelor's degree with a major in economics or another applied field and a minor in statistics is preferable. A graduate degree in mathematics or statistics is essential for college and university teaching and helpful for promotion to top administrative and consulting jobs. Advancement in analytical and survey work usually requires graduate training.

Fewer than 80 colleges and universities offered a bachelor's degree in statistics in 1972. However, most schools offer either a degree in mathematics or a sufficient number of courses in statistics to qualify graduates for beginning positions. Required subjects include mathematics through differential and integral calculus, statistical methods, and probability theory. Courses in computer uses and techniques are useful for many jobs. For quality control positions, training in engineering or a physical or biological science and in the application of statistical methods to manufacturing processes is desirable. For many market research, business analysis, and forecasting jobs, courses in economics, business administration, or a related field are helpful.

About 100 colleges and universities offered graduate degrees in statistics in 1972, and many other schools offered one or two graduate level statistics courses. The usual requirement for entering a graduate program is a bachelor's degree with a good background in mathematics. Students should attend schools where they can do research in a subject-matter field, as well as take advanced courses in statistics.

Beginning statisticians who have only the bachelor's degree often spend much of their time performing routine statistical work. Through experience, they may advance to positions of greater technical and supervisory responsibility. Those who have exceptional ability and interest may rise to top management positions.

Employment Outlook

Employment opportunities for well-qualified persons who can combine training in statistics with knowledge of a field of application are expected to be favorable through the mid-1980's. In addition to job openings resulting from the rapid growth expected in the profession, hundreds of statisticians will be needed each year to replace those who retire, die, or transfer to other occupations.

Private industry will require increasing numbers of statisticians for quality control in manufacturing. Statisticians with a knowledge of engineering and the physical sciences will find jobs working with scientists and engineers in research and development. Business firms will rely more heavily on statisticians to forecast sales, analyze business conditions, modernize accounting procedures, and help solve management problems.

Government agencies will need statisticians for existing and new programs in fields such as social security, health, education, and economics. Colleges and universities will employ others to teach a growing number of students, as the broader use of statistical methods makes such courses increasingly important to persons majoring in fields other than mathematics and statistics.

Earnings and Working Conditions

In 1972, statisticians earned average salaries almost three times as high as the average for nonsupervisory workers in private industry, except farming. New college graduates averaged about $9,300 a year, according to the limited information available. Those with the master's degree could start at about $11,000 a year.

In the Federal Government in early 1973, statisticians who had the bachelor's degree and no experience could start at either $7,649

or $9,520 a year, depending on their college grades. Beginning statisticians with the master's degree could start at $11,614 or $13,996. Those with the Ph.D. could begin at $13,996 or $16,682.

Statisticians employed by colleges and universities generally receive salaries comparable to those paid other faculty members. (See statement on College and University Teachers.) In addition to their regular salaries, statisticians in educational institutions sometimes earn extra income from outside research projects, consulting, and writing.

Sources of Additional Information

For information about career opportunities in statistics, contact:

American Statistical Association, 806 15th St., NW., Washington, D.C. 20005.

Facts on Federal Government jobs are available from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St., NW., Washington, D.C. 20414.

For a list of reading materials on career opportunities in data processing, contact:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

PHYSICAL SCIENTISTS

Physical scientists deal with the basic laws of the physical world. Many, especially physicists and astronomers, do basic research to increase man's knowledge of the properties of matter and energy. Others, particularly chemists and food scientists, do basic and applied research, and develop new products and processes. For example, chemists in applied research use their knowledge of the interactions of various chemicals to improve the quality of products. Besides research and development, many chemists, food scientists, and some physicists work in production and sales-related activities in industry.

This section describes four physical science occupations—those of chemists, physicists, astronomers, and food scientists. Engineers, life scientists, and environmental scientists also require a background in the physical sciences; these occupations are described in separate sections elsewhere in the *Handbook*.

ASTRONOMERS

(D.O.T. 021.088)

Nature of the Work

How was our solar system created? Why do the stars shine? What do cosmic rays tell us about the origin of our universe? Astronomers—sometimes called *astrophysicists*—consider questions like these and, using the principles of physics and mathematics, study the structure and evolution of the universe. They collect and analyze data on the sun, moon, planets, and stars to determine the size, shape, temperature, chemical composition, and motion of these bodies. They also study the gases and dusts in space. One use of this data is to determine the age and size of the stars and how they were formed.

Astronomers compute the positions of the planets; calculate the orbits of comets, asteroids, and artificial satellites; and study the origin and nature of cosmic radiation. They also study the size and shape of the earth and the properties of its atmosphere.

To make observations of outer space, astronomers use complex photographic techniques, light-measuring instruments, and other optical devices. They use, for example, the spectroscope, a telescope with a prism attached, to separate light into its component colors and identify chemical elements in the universe. Yet astronomers actually spend a limited amount of time at the telescope. They also use other specialized devices for making observations of radio waves, X-rays, gamma rays, and cosmic rays. These instruments often are carried by balloons, rockets, and satellites. Electronic computers are useful for processing astronomical data to calculate orbits of asteroids or comets, guide spacecraft, and work out tables for navigational handbooks.

Astronomers usually specialize in one of the many branches of the science. Some areas of specialization are instruments and techniques, the sun, the solar system, and the evolution and interiors of stars.

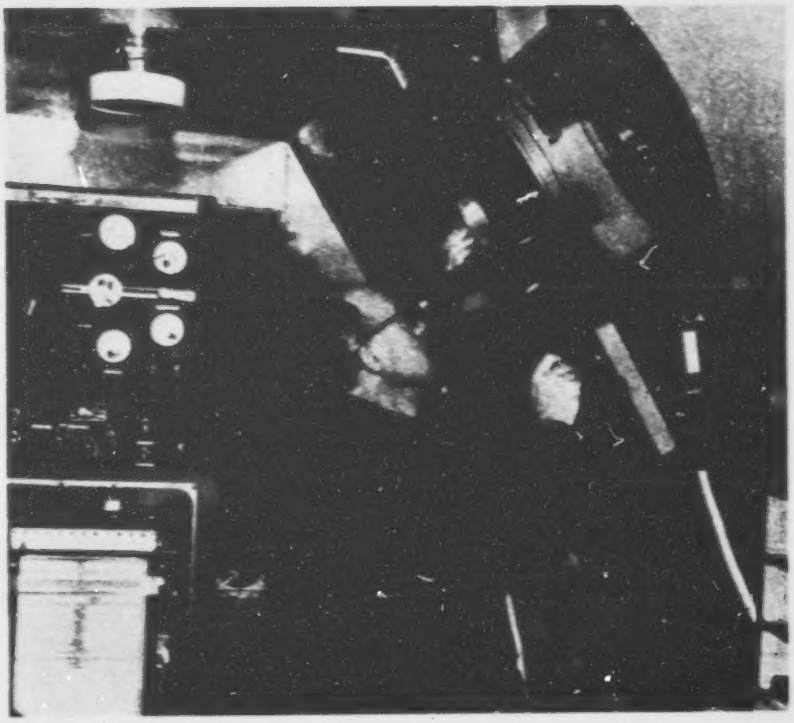
Astronomers who work on observational programs begin their studies by deciding what stars or other objects to observe and what methods and instruments to use. They may need to design optical measuring devices to attach to the telescope to make the required measurements. These devices may be made in the observatory shop. After these astronomers complete their observations, they analyze the results, present them in precise numerical form, and try to explain them on the basis of some theory.

Other astronomers concentrate on theoretical problems. They may formulate theories or mathematical models to explain observations made earlier by another astronomer. These astronomers develop mathematical equations from the laws of physics to compute, for example, theoretical models of how stars change as their nuclear energy sources become exhausted.

More than 85 percent of all astronomers teach or do research; some do both in colleges and universities. In some schools that do not have separate departments of astronomy or only small enrollments in the subject, astronomers may teach courses in mathematics or physics as well as astronomy. Other astronomers administer research programs, develop and design astronomical instruments, and do consulting work.

Places of Employment

Astronomy is one of the smallest of the physical sciences; about 2,000 persons worked as astronomers in 1972. Most astronomers work in colleges and universities. Some of these work in university-operated observatories, where they usually devote most of their time to research. Other astronomers work



for observatories financed by nonprofit organizations.

The Federal Government employed over 100 astronomers in 1972. Most worked for the Department of Defense, mainly at the U.S. Naval Observatory and the U.S. Naval Research Laboratory. Others worked for the National Aeronautics and Space Administration or the National Science Foundation. A few astronomers worked for firms in the aerospace field, or in museums and planetariums.

Training, Other Qualifications, and Advancement

The usual requirement for a job in astronomy is a Ph.D. degree. Although persons with less education may qualify for some beginning jobs, high-level positions in teaching and research and advancement in most areas are open only to those with the doctorate.

In 1972, only 52 colleges and universities had programs leading to the bachelor's degree in astronomy. However, students with a bachelor's degree in physics or mathematics with a physics minor can usually qualify for graduate programs in astronomy. Students planning to become astronomers usually study subjects that include physics, mathematics, and chemistry. Courses in statistics, computer science, and electronics also are useful. In schools with astronomy departments, students also take introductory courses in astronomy and astrophysics, and in astronomical techniques and instruments.

About 55 colleges and universities in various sections of the country offer the Ph.D. degree in astronomy. The graduate student takes advanced courses primarily in astronomy, physics, and mathematics. Some schools require that graduate students spend several months working at an observatory. In most institutions the work program leading to the doctorate is flexible and allows students to take courses in their own particular area of interest.

Young people planning on careers in astronomy should have inquisitive minds and imagination. Perseverance and the ability to concentrate on detail and work independently also are important.

New graduates with a bachelor's or master's degree in astronomy usually begin as assistants in observatories, planetariums, large departments of astronomy in colleges and universities, Government agencies, or industry. Some work as research assistants while studying toward advanced degrees; others, particularly in the Federal Government, receive on-the-job training in the application of astronomical principles. New graduates with the doctorate can qualify for teaching and research jobs in colleges and universities and for research jobs in Government and industry.

Employment Outlook

Future opportunities for astronomers are heavily dependent on the amount of funds spent by the Federal Government for basic research in astronomy. These funds are expected to continue to increase through the mid-1980's, but at a slower rate than during the 1960's. Although relatively few college students are expected to receive the Ph.D. in astronomy in any one year, the number of job openings in any year may be even lower. Thus, competition may develop for beginning jobs. People without the Ph.D. are not usually considered professional astronomers, but may find jobs as research and technical assistants.

Requirements for astronomers are affected to some extent by the needs

of the space program—rockets, missiles, manmade earth satellites, and space exploration. Astronomers analyze the data collected by rockets and spacecraft, and give direction to the astronomical observations that can only be carried out by means of equipment placed in space vehicles.

Earnings and Working Conditions

Astronomers have relatively high salaries, with average earnings almost three times as high as the average for non-supervisory workers in private industry, except farming.

In the Federal Government in early 1973, astronomers holding the Ph.D. degree could begin at $13,996 or $16,682, depending on their college record. Those having the bachelor's degree could start at $7,619 or $9,520; with the master's degree at $11,614 or $13,996.

In private industry, starting salaries averaged $8,700 a year for those having the bachelor's degree, $11,000 for those having the master's degree, and $12,000 for those having the Ph.D. degree, according to the limited data available. Astronomers teaching in colleges and universities received salaries equivalent to those of other faculty members. (See statement on College and University Teachers elsewhere in the *Handbook*.)

Although most modern astronomers do not make direct observations but analyze data from satellites and radio telescopes, some still do nightwork. These people make visual photographic or photoelectric observations involving exposure to the outside air through the open dome of the observatory, sometimes on cold winter nights.

Sources of Additional Information

For information on careers in astronomy and on schools offering training in the field, contact:

American Astronomical Society, 211 FitzRandolph Rd., Princeton, N.J. 08540.

Facts on Federal Government careers are available from any regional office of the U.S. Civil Service Commission or from:

Interagency Board of Civil Service Examiners for Washington, D.C. 1900 E St. NW., Washington, D.C. 20415.

CHEMISTS

(D.O.T. 022.081, .168, .181, and .281)

Nature of the Work

The clothes we wear, the foods we eat, the houses in which we live—in fact most things that help make our lives better, from medical care to a cleaner environment—result, in part, from the work done by chemists.

Chemists investigate the properties and composition of matter and the laws that govern the combination of elements. They search for and try to put into practical use new knowledge about substances. They apply scientific principles and techniques and use many specialized instruments to measure, identify, and evaluate changes in matter. Chemists maintain accurate records of their work and prepare reports showing results of tests or experiments.

Chemists may develop new substances, such as rocket fuel, or inspect and test final products to make sure they meet industry and government standards. The materials with which chemists work vary by industry. For example, in the health field, chemists may develop vaccines, but in the food industry, they may develop food additives. (See statements on Biochemists and Food Scientists elsewhere in the *Handbook*.)

Nearly two-fifths of all chemists work in research and development. In basic research, chemists try to extend scientific knowledge rather than solve practical problems. Basic research results, however, have practical uses. For example, research on how and why small molecules unite to form larger ones (polymerization) has been used to make synthetic rubber and plastics. Chemists in research and development often create new products. Top management, for example, may give the chemists a description of a needed item. If similar products exist, chemists test samples to determine their ingredients. If similar products are not available, chemists experiment with various substances to obtain a product with the required specifications.

Over one-fourth of all chemists administer and manage programs, especially those related to research and development. Nearly one-fifth of all chemists work in production and inspection activities. In production operations, chemists prepare instructions (batch sheets) for plant workers and specify the kind and amount of ingredients to use and the exact mixing time for each stage in the process. At each step, chemists test samples for quality control to insure that they meet industry and government standards. Chemists in these areas also are concerned with improving products and processes. Others work as marketing or sales representatives when the job requires a technical knowledge of the various products. More than one-tenth of all chemists teach in colleges and universities where they may do some research. Some chemists are consultants to private industry firms and government agencies.

Places of Employment

Nearly 134,000 persons worked as chemists in 1972; about 10 percent were women. More than two-thirds of all chemists work in private industry; half are in the chemicals manufacturing industry. Most of the remainder work for companies manufacturing food, scientific instruments, petroleum, paper, and electrical equipment.

Colleges and universities employed more than 25,000 chemists. A smaller number worked for nonprofit research organizations. A number of chemists are employed by Federal Government agencies, chiefly the Departments of Defense; Health, Education, and Welfare; Agriculture; and Interior. Small numbers work for State and local governments, primarily in agencies concerned with health or agriculture.

Chemists are employed in all States, but usually are concentrated in large industrial areas. Nearly one-fifth of all chemists were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark. About half of the total worked in six States—New York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in chemistry is usually the minimum requirement for starting a career as a chemist. Graduate training is essential for many positions, particularly in research and college teaching.

Over 1,000 colleges and universities offer a bachelor's degree in chemistry. In addition to the required chemistry courses (analytical, inorganic, organic, and physical chemistry), undergraduates take courses in mathematics (especially geometry and calculus) and physics.

Over 300 colleges and universities award advanced degrees in chemistry. In graduate school, students usually specialize in a particular field of chemistry. Requirements for the master's or doctor's degree vary, but usually include a thesis based on independent research.

Students planning careers as chemists should enjoy studying science and mathematics, and ought to like working with their hands to build scientific apparatus and to perform experiments. Perseverance and the ability to concentrate on detail and work independently are essential. Other desirable assets include an inquisitive mind, a good memory, and imagination. Chemists also should have good eyesight and good eye-hand coordination.

New graduates with the bachelor's degree generally begin their careers in government or industry by analyzing or testing products, working in technical sales or service, or assisting senior chemists in research and development laboratories. Many employers have special training and orientation programs for new graduates. These programs are concerned with special techniques and help new graduates determine the types of work best suited to their interest and talents. Candidates for an advanced degree often teach or do research in colleges and universities while working toward advanced degrees. They also may qualify as secondary school teachers.

Beginning chemists with the master's degree can usually go into applied research positions in government or private industry. They also may qualify for some teaching positions in colleges and universities and many positions in 2-year colleges.

The Ph.D. generally is required for basic research, for teaching in colleges and universities, and for advancement to most administrative positions.

Employment Outlook

Employment opportunities for new chemistry graduates are expected to be favorable through the mid-1980's. In addition to opportunities resulting from the very rapid growth expected for this profession, thousands of new chemists will be needed each year to replace those who retire, die, or transfer to other occupations.

The favorable outlook for chemists assumes that additional chemists will be needed for research and development work. Research and development expenditures of government and industry are expected to increase through the mid-1980's, although at a slower rate than during the 1960's. The expected slowdown in Federal R&D spending basically reflects anticipated shifts in the relative importance of space and defense. However, if actual R&D expenditures levels and patterns differ significantly from those assumed, the outlook for chemists would be altered.

Growth in demand for industrial products, including plastics, man-made fibers, drugs, and fertilizers will increase employment opportunities for chemists. For example, chemists will be needed both by industrial companies and government agencies to help solve pollution control problems, establish better health care programs, and do health-related research in hospitals. New and better solid and liquid fuels to stem fuel shortages could require more chemists. Some also will be needed to work in Federal, State, and local crime laboratories.

Larger enrollments through the mid-1980's will require more chemists, especially Ph.D.'s, to teach in colleges and universities. Additional opportunities will become available in 2-year colleges. (See statements on colleges and universities elsewhere in the *Handbook*.)

New graduates also will find openings in high school teaching after completing professional education courses and other requirements for a State teaching certificate. However, they usually are regarded as teachers rather than as chemists. (See statement on Secondary School Teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

Chemists have relatively high salaries, with average earnings about twice those received by nonsupervisory workers in private industry, except farming. According to the American Chemical Society, annual salaries for experienced chemists having a bachelor's degree averaged $15,600 in 1972; for those with a master's degree, $16,300; and for those with a Ph.D, $19,200.

Private industry paid inexperienced chemists with the bachelor's degree starting salaries of $9,000 a year; those with the master's degree $10,300; and those with the Ph.D. $15,600. In colleges and universities, those with the master's degree earned $8,100 and those with the Ph.D. averaged $10,920 to start. Many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing.

Depending on college records, the annual starting salary in the Federal Government in early 1973 for an inexperienced chemist with a bachelor's degree was either $7,694 or $9,520. Beginning chemists who had 1 year of graduate study could start at $9,520 and those who had 2 years of graduate study, at $11,614. Chemists having the Ph.D. degree could start at $13,996 or $16,682.

Chemists work mostly in modern, well-equipped, well-lighted laboratories, offices, or classrooms. Hazards involve handling potentially explosive or highly caustic chemicals. However, when safety regulations are followed health hazards are negligible.

Chemist records results of experiments.

Sources of Additional Information

General information on career opportunities and earnings for chemists may be obtained from:

American Chemical Society, 1155 16th St., NW., Washington, D.C. 20036.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave., NW., Washington, D.C. 20009.

Specific information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St., NW., Washington, D.C. 20415.

For additional sources of information, see statements on Biochemists, Chemical Engineers, and Industrial Chemical Industry. Information on chemical technicians may be found in the statement on Technician Occupations.

FOOD SCIENTISTS

(D.O.T. 022.891,040.081,041.081)

Nature of the Work

Someone has estimated that the average family of four consumes over 5,000 pounds of food a year. In the past, housewives processed most food in the home, but today, industry processes almost all foods. People in many occupations are involved with food processing. A key worker is the *food scientist* or *food technologist*.

Food scientists investigate the chemical, physical, and biological nature of food and apply this knowledge to processing, preserving, packaging, distributing, and storing an adequate, nutritious, wholesome, and economical food supply. About three-fifths of all scientists in food processing work in research and development. Others work in quality assurance laboratories or in production or processing areas of food plants. Some teach or do basic research in colleges and universities.

Food scientists in basic research study the structure and composition of food and the changes it undergoes in storage and processing. For example, they may develop new sources of proteins, study the effects of processing on microorganisms, or search for factors that affect the flavor, texture, or appearance of foods. Food scientists who work in applied research and development create new foods and develop new processing methods. They also seek to improve existing foods by making them more nutritious and enhancing their flavor, color, and texture.

Food scientists test food for color and flavor.

Food scientists insure that each new product will retain its characteristics and nutritive value during storage. They also may conduct chemical and microbiological tests to see that products meet industry and government standards. Others test additives for purity, investigate changes that take place during processing, or develop mass-feeding methods for food service institutions.

In quality control laboratories, food scientists check raw ingredients for freshness, maturity, or suitability for processing. They may use machines that test for tenderness by finding the amount of force necessary to puncture the item. Periodically, they inspect processing line operations to insure conformance with government and industry standards. For example, scientists test canned goods for sugar, starch, protein, fat, vitamin, and mineral content. In frozen food plants, they make sure that, after processing, various enzymes are inactive so that the food won't spoil during storage. Others are concerned with packaging materials that maintain shelf life and product stability. They often supervise technicians who assist in product testing. (See statement on Food Processing Technicians elsewhere in the *Handbook*.)

Food scientists in production schedule processing operations, prepare production specifications, maintain proper temperature and humidity in storage areas, and supervise sanitation operations, including the efficient and economical disposal of wastes. To increase efficiency, they advise management on the purchase of equipment and recommend new sources of materials.

Food scientists maintain records and reports that show results of tests or experiments.

In addition, some food scientists work in market research, advertising, and technical sales. Others teach in colleges and universities.

Places of Employment

About 7,500 persons, almost 15 percent women, worked as food scientists in 1972. Food scientists work in all sectors of the food industry and in every state. The types of product on which they work may depend on where in the country they work: for example, in Maine and Ohio they work with potatoes; in New York and Pennsylvania, with flavor ingredients; in the Mid-west, with cereal products or meat packing; and in Florida and California, with orange juice. The greatest number work in California, Illinois, New York, Pennsylvania, Texas, Ohio, New Jersey, Wisconsin, Michigan, and Iowa.

Some food scientists do research for Federal agencies such as the Food and Drug Administration and the Departments of Agriculture and Defense; others work in State regulatory agencies. A few work for private consulting firms and international organizations such as the United Nations. Some teach or do research in colleges and universities. (See statement on College and University Teachers elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in food science, or in one of the physical or life sciences such as

chemistry and biology, is the usual minimum requirement for beginning jobs in food science. An advanced degree is necessary for many jobs, particularly research and college teaching, and for some management level jobs in industry.

Nearly 60 colleges and universities offered programs leading to the bachelor's degree in food science in 1972; the Institute of Food Technologists approved 30 of these. Undergraduate students usually take courses in physics, chemistry, mathematics, biology, the social sciences and humanities, and business administration, as well as specialized food science courses.

Most of the colleges and universities that provide undergraduate food programs also offer advanced degrees. Graduate students usually specialize in a particular area of food science. Requirements for the master's or doctor's degree vary by institution, but usually include laboratory work and a thesis.

Young people planning careers as food scientists should have analytical minds and like details and technical work. Food scientists must express their ideas to others and understand other people's ideas. Flexibility, imagination, and creativity are important in meeting food needs for an expanding population.

A food scientist with a bachelor's degree might start work as a quality assurance chemist or as an assistant production manager. After gaining experience the food scientist can advance to more responsible management jobs. The scientist also might begin as a junior food chemist in a research and development laboratory of a food company, and be promoted to section head or another research management position.

People who have master's degrees may begin as senior food chemists in a research and development. Those who have the Ph.D. probably would begin their careers doing basic research or teaching.

Employment Outlook

Employment of food scientists is expected to grow moderately through the mid-1980's. In addition to openings resulting from this growth, some jobs will open each year because of the need to replace those who die, retire, or transfer to other fields.

Employment is expected to grow as the food industry responds to the need for a wholesome and economical food supply for an increasing population. In addition, both private households and food service institutions that supply outlets such as airlines and restaurants will demand a greater quantity of quality convenience foods.

An increasing number of food scientists are expected to find jobs in research and product development. In recent years, expenditures for research and development in the food industry have increased moderately and probably will continue to rise. Research could produce new foods from modifications of wheat, corn, rice, and soybeans. For example, food scientists may create "meat" products from these vegetable proteins that resemble beef, pork, and chicken. There will be an increased need for food scientists in quality control and production because of the complexity of products and processes and the application of higher processing standards and new government regulations.

Earnings and Working Conditions

Food scientists had relatively high earnings in 1972, over twice as much as the average for nonsupervisory workers in private industry, except farming. Those with a bachelor's degree and no experience had starting salaries of about $9,000 a year, according to the limited data available. Those with a master's degree started at about $10,200, and those with the Ph.D. at about $14,250.

In the Federal Government in early 1973, Food Scientists with a bachelor's degree could start at $7,694 or $9,520 a year, depending on their college grades. Those with a master's degree could start at $9,520 or $11,614, and those with the Ph.D. degree could begin at $13,996 or $16,682. Food scientists in colleges and universities earned the same salaries as other faculty members.

Sources of Additional Information

For information on careers in food science and a list of schools offering programs in food science contact:

The Institute of Food Technologists, Suite 2120, 221 North LaSalle St., Chicago, Ill. 60601.

PHYSICISTS

(D.O.T. 023.081 and .088)

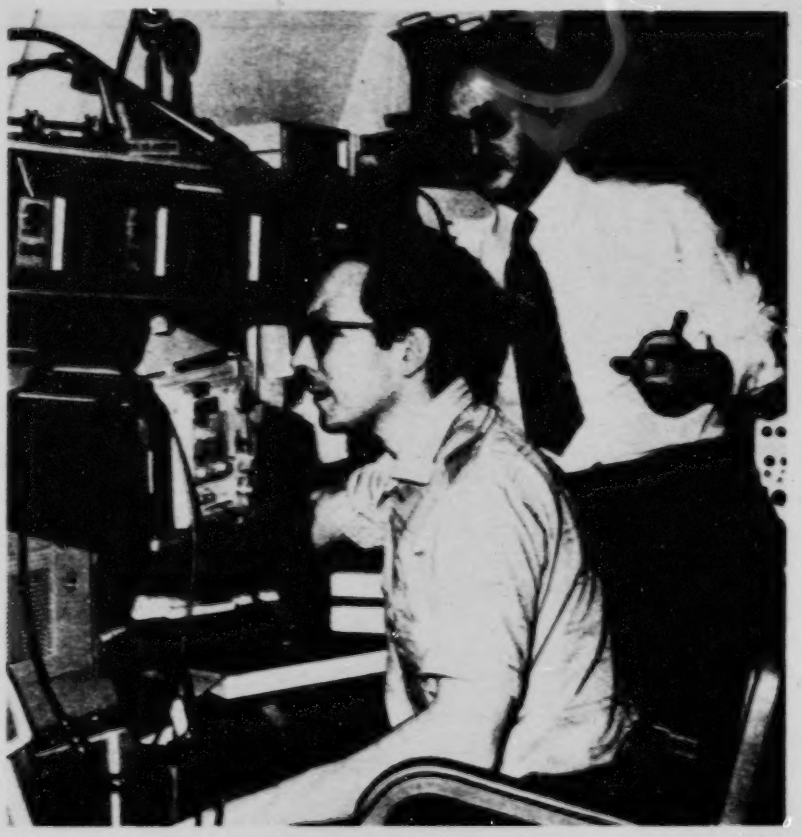
Nature of the Work

The flight of astronauts through space, the probing of ocean depths, or even the safety of the family car depend on research by physicists. Through systematic observation and experimentation, physicists describe in mathematical terms the structure and interactions between matter and energy. Physicists develop theories and discover the fundamental laws that describe forces within the universe. Determining basic laws governing phenomena such as gravity, electromagnetism, and heat flow leads to discoveries

and innovations. For instance, the development of irradiation therapy equipment which destroys harmful growths in humans without damaging other tissues resulted from what physicists know about radioactivity. Physicists have contributed to scientific progress in recent years in areas such as nuclear energy, electronics, communications, and aerospace.

Over half of all physicists work in research and development. Some do basic research to increase scientific knowledge. For example, they determine the relationships between the fundamentals of nuclear structure and the fundamental forces between nucleons (nuclear dynamics). The equipment that physicists develop for their basic research can often be applied to other areas. For example, lasers (a device which amplifies light and emits electromagnetic waves in a narrow, intense light beam) are utilized in surgery; microwave devices are used for ovens; and measurement techniques and instruments developed by physicists can detect and measure the kind and number of cells in blood.

Some engineering oriented physicists do applied research and help develop new products. For instance, their knowledge of solid-state physics led to the development of transistors and micro-circuits used in electronic equipment that ranges from hearing aids to missile guidance systems.



Physicists work with complex equipment such as atomic accelerators.

About one-fifth of all physicists teach in colleges and universities. Almost another fifth work in management and administration, especially research and development programs. A small number work in inspection, quality control, and other production related jobs in industry. Some do consulting work.

Most physicists specialize in one or more branches of the science—elementary-particle physics; nuclear physics; atomic, electron, and molecular physics; physics of condensed matter; optics, acoustics, and plasma physics; and the physics of fluids. Some specialize in a subdivision of one of these branches. For example, within solid-state physics concentration may include ceramics, crystallography, or semiconductors. However, since all physics specialties rest on the same fundamental principles, a physicist's work often overlaps many specialties.

Growing numbers of physicists are specializing in fields combining physics and a related science—such as astrophysics, biophysics, chemical physics, and geophysics. Furthermore, the practical applications of physicists' work have increasingly merged with engineering.

Places of Employment

About 49,000 people worked as physicists in 1972; nearly 4 percent were women. Private industry employed over 19,000; almost two-fifths of these were in companies manufacturing chemicals, electrical equipment, and ordnance products. Commercial laboratories and independent research organizations employ more than one-fourth of the physicists in private industry.

More than 22,000 physicists either taught or did research in colleges and universities; some did both. Over 6,000 physicists were in the Federal Government in 1972, most-

ly the Department of Defense. The Department of Commerce also employs large numbers of physicists. About 1,300 physicists worked in nonprofit organizations.

Although physicists are employed in all States, their employment is greatest in areas that have heavy industrial concentrations and large college and university enrollments. Nearly one-fourth of all physicists work in four metropolitan areas—Washington, D.C.; Boston; New York; and Los Angeles-Long Beach, and more than one-third are concentrated in three states—California, New York, and Massachusetts.

Training, Other Qualifications, and Advancement

A bachelor's degree in physics is the minimum requirement for young people beginning work as physicists. However, graduate training is increasingly the hallmark of full professional status and is essential for many entry jobs and for advancement in all types of work. The doctorate is usually required for full faculty status at colleges and universities and for jobs administering research and development programs.

Physicists who have master's degrees qualify for many research jobs. Some instruct and conduct laboratory sessions in colleges and universities while working for their Ph.D.

Physicists who have bachelor's degrees qualify for many applied research and development jobs in private industry or the Federal Government. Some become research assistants in colleges and universities while working toward advanced degrees. Many with a bachelor's degree in physics enter nontechnical work, other science fields, or become engineers.

Almost 900 colleges and universities offer a bachelor's degree in physics. In addition, many engineering schools offer a physics major as part of the general curriculum. The undergraduate program in physics provides a broad background in the science and serves as a base for later specialization either in graduate school or on the job. Some typical physics courses are mechanics, electricity, and magnetism, optics, thermodynamics, and atomic and molecular physics. Students also take courses in chemistry and mathematics.

More than 300 colleges and universities offer advanced degrees in physics. In graduate school, the student, with faculty guidance, usually works in a specific field. The graduate student, especially the candidate for the Ph.D. degree, spends a large portion of his time in research.

Students planning a career in physics should have an inquisitive mind, good memory, and imagination. They must distrust conventional assumptions about the universe and be eager to try a new approach to discovering truths. Physicists doing basic research generally receive less supervision than those in mission-oriented applied research and development.

Employment Outlook

Physicists with advanced degrees should have favorable employment opportunities through the mid-1980's, primarily in applied research and development. In addition to opportunities resulting from the moderate growth expected in this field, physicists will be needed each

Physicists develop equipment used in cancer research.

year to replace those who transfer to other fields of work, retire, or die.

Some of the past increases in employment of physicists resulted from increases in Federal research and development (R&D) expenditures, especially for space and defense related programs. Physicists will continue to be required to do complex R&D in both defense and nondefense related areas. Through the mid-1980's, R&D expenditures of Government are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in the rate of growth basically reflects the declining priority given to space and defense R&D programs. However, if actual R&D expenditure levels and patterns were to differ significantly from those assumed, the outlook for physicists would be altered.

Some physicists with advanced degrees will be needed to teach in colleges and universities, primarily because of the growing need for physics training in all science and engineering programs.

New graduates also will find opportunities in other occupations that utilize their training. For example, they may become high school teachers after completing the required educational courses and obtaining a State teaching certificate. However, they are usually regarded as teachers rather than as physicists. (See statement on Secondary School Teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

Physicists have relatively high salaries, with average earnings more than twice those received by nonsupervisory workers in private industry, except farming. Starting salaries for physicists who have the bachelor's degree averaged about $9,900 a year in manufacturing industries in 1972, those having master's degrees $11,800, and those having the Ph.D. $16,000.

Depending on their college records, physicists who have a bachelor's degree and no experience could start work in the Federal Government in early 1973 at either $7,694 or $9,520. Beginning physicists completing all requirements for the master's degree could start at $9,520 or $11,614. Physicists having the Ph.D. degree could begin at $13,996 or $16,682.

Starting salaries on college and university faculties for physicists with a master's degree averaged $10,200 in 1972, and salaries for those having the Ph.D. averaged $11,800. (See statement on College and University Teachers elsewhere in the *Handbook*.) Many faculty physicists supplement their regular incomes by working as consultants and taking on special research projects.

Young physicists may begin their careers doing routine laboratory tasks. After some experience, they are assigned more complex tasks and may advance to project leaders or research directors. Some work in top management jobs. Physicists who develop new products sometimes form their own companies or join new firms to exploit their ideas.

Sources of Additional Information

General information on career opportunities in physics is available from:

American Institute of Physics, 335 East 45th St., New York, N.Y. 10017.

For information on Federal Government careers contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St., NW., Washington, D.C. 20415.

TECHNICIAN OCCUPATIONS

Before World War II scientists and engineers worked directly with craftsmen and other skilled workers. For example, an engineer might design and develop a product or process, while skilled workers would carry out the more routine parts of the plan. Because of rapid technological advances, however, it became more difficult for skilled workers, who usually had a limited knowledge of science and mathematics, to work directly with scientists and engineers. A need developed for workers, called technicians, specifically trained to assist engineers and scientists, or in some cases to do work that otherwise would have to be done by engineers or scientists.

Although technician occupations have grown rapidly, the term "technician" has no generally accepted definition. Employers use it to refer to workers in a variety of jobs requiring a wide range of education and training. The term is used to describe employees doing relatively routine work, persons performing work requiring technical but limited skills, and those doing highly technical work, including persons working closely with engineers and scientists.

In this chapter, "technicians" refers to workers who use engineering, scientific, and mathematical theory; who have specialized education and/or training in some aspect of technology or science; and who generally work directly with engineers and scientists. This chapter contains statements on engineering and science technicians, food processing technicians, draftsmen, surveyors, and broadcast technicians. Information on technical occupations in the health field—including dental laboratory technicians, radiological technologists, and dental hygienists—is presented elsewhere in the *Handbook*.)

BROADCAST TECHNICIANS

(D.O.T. 194.281, .282, and .782; 957.282; and 963.168 through .887)

Nature of the Work

Broadcast technicians operate and maintain the electronic equipment used to record or transmit radio and television programs. They work with microphones, sound recorders, light and sound effects, television cameras, video tape recorders, and other equipment.

In the control room, broadcast technicians operate equipment that regulates the quality of sounds and pictures being recorded or broadcast. They also operate controls that switch broadcasts from one camera or studio to another, from film to live programming, or from network to local programs. By means of hand signals and, in television, by use of telephone headsets, they give technical directions to personnel in the studio.

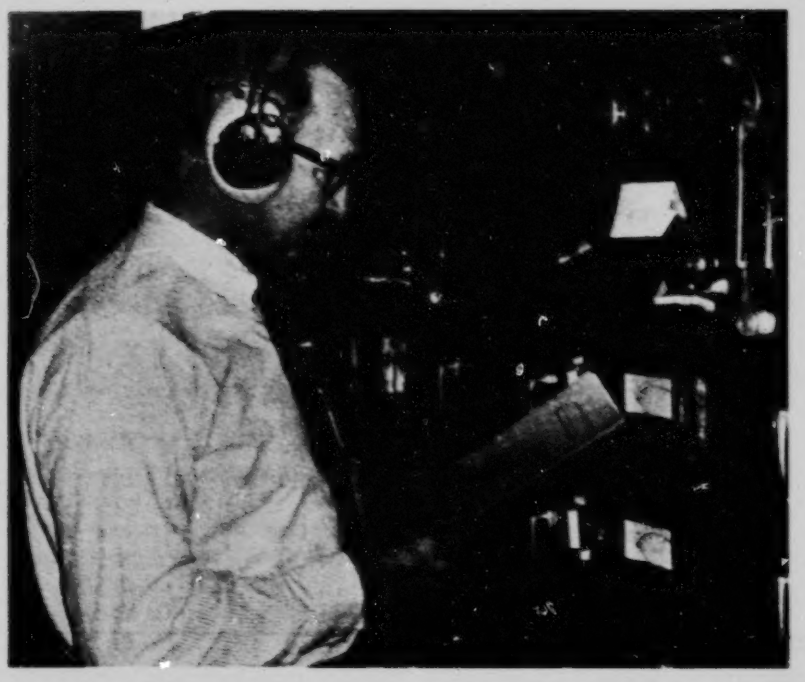
When events outside the studios are to be broadcast, technicians may go to the site and set up, test, and operate the necessary equipment. After the broadcast, they dismantle the equipment and return to the station.

As a rule, broadcast technicians in small stations perform a variety of duties. In large stations and in networks, on the other hand, technicians are more specialized, although specific job assignments may change from day to day. *Transmitter technicians* monitor and log outgoing signals and are responsible for transmitter operation. *Maintenance technicians* set up, maintain, and repair electronic broadcasting equipment. *Audio control technicians* regulate sound pickup, transmission, and switching. *Video control technicians* regulate the quality, brightness, and contrast of television pictures. *Lighting technicians* direct lighting of television programs. *Field technicians* set up and operate broadcasting equipment for programs originating outside the studio. *Recording technicians* operate and maintain sound recording equipment. *Video recording technicians* operate and maintain video tape recording equipment. Sometimes the term "engineer" is substituted for "technician" in the above titles.

Places of Employment

About 22,000 broadcast technicians were employed in radio and television stations in 1972. Most radio stations employ fewer than four technicians, although a few large ones have more than 10. Nearly all television stations employ at least five broadcast technicians, and those in large metropolitan areas average about 30. In addition to the technicians, several thousand supervisory personnel, with job titles such as chief engineer and director of engineering, work in technical departments.

Broadcast technicians are employed in every State, particularly in the larger cities. The highest



Broadcast technician plays back tape.

paying and most specialized jobs are concentrated in New York, Los Angeles, and Washington, D.C.—the originating centers for most of the network programs.

Training, Other Qualifications, and Advancement

A young person interested in becoming a broadcast technician should plan to get a Radiotelephone First Class Operator License from the Federal Communications Commission (FCC). Federal law requires that anyone who operates or adjusts broadcast transmitters in television and radio stations must hold such a license. Some stations require all their broadcast technicians including those who do not operate transmitters to have this license. Applicants for the license must pass a series of written examinations. These cover construction and operation of transmission and receiving equipment; characteristics of electromagnetic waves; and regulations and practices, both Federal government and international, governing broadcasting. Information about these examinations and guides to study for them may be obtained from the Federal Communications Commission, Washington, D.C. 20036.

Among high school courses, algebra, trigonometry, and physics and other sciences provide valuable background for young persons anticipating careers in this occupation. In terms of practice, building and operating an amateur radio station also is good training. Taking an electronics course in a technical school is still another good way to acquire the knowledge for becoming a broadcast technician. Some young persons gain work experience as temporary employees filling in for regular broadcast technicians while they are on vacation.

Many schools give courses especially designed to prepare the student for the FCC's first-class license test. Having training at the level of technical school or college is an advantage for those who hope to advance to supervisory positions or to the more specialized jobs in large stations and in the networks.

Young persons with FCC first-class licenses who get entry jobs are instructed and advised by the chief engineer or by other experienced technicians concerning the work procedures of the station. In small stations, they may start by operating the transmitter and handling other technical duties, after a brief instruction period. As they acquire more experience and skill they are assigned to more responsible jobs. Those who demonstrate above-average ability may move into top-level technical positions, such as supervisory technician and chief engineer. A college degree in engineering is becoming increasingly important for advancement to supervisory and executive positions.

Employment Outlook

The number of broadcast technicians is expected to increase slowly through the mid-1980's. Most job openings will result from the need to replace experienced technicians who retire, die, or transfer to other occupations.

Some new job opportunities for technicians will be provided as new radio and television stations open. However, labor-saving technical advances, such as automatic programming, automatic operation logging, and remote control of transmitters will limit the demand for technicians.

Earnings and Working Conditions

Salaries of beginning technicians in commercial radio and television

ranged from about $100 to $170 a week in 1972 and those of experienced technicians from about $130 to $320, according to the limited information available. As a rule, technicians' wages are highest in large cities and in large stations. Technicians employed by television stations usually are paid more than those who work for radio stations because television work is generally more complex. Technicians employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most technicians in large stations work a 40-hour week with overtime pay for work beyond 40 hours. Many broadcast technicians in the larger cities work a 37-hour week. In small stations, many technicians work 2 to 8 hours of overtime each week. Evening, night, and weekend work frequently is necessary since many stations are on the air as many as 24 hours a day, 7 days a week. Network technicians may occasionally have to work continuously for many hours and under great pressure in order to meet broadcast deadlines. Most technicians receive paid vacations. Typically, vacations range from 1 to 4 weeks, depending on length of service.

Technicians generally work indoors in pleasant surroundings. The work is interesting, and the duties are varied. When remote pickups are made, however, technicians may work out of doors at some distance from the studios, under less favorable conditions.

Sources of Additional Information

General information careers for broadcast technicians may be obtained from:

National Association of Broadcasters, 1771 N St., NW., Washington, D.C. 20036.

Corporation for Public Broadcasting, 888 16th St., NW., Washington, D.C. 20006.

DRAFTSMEN

(D.O.T. 001.281, 002.281, 003.281, 005.281, 007.281, 010.281, 014.281, and 017.)

Nature of the Work

When making a space capsule, television set, building, or bridge, workers follow drawings that show the exact dimensions and specifications of the entire object and each of its parts. Workers who draw these plans are draftsmen.

Draftsmen prepare detailed drawings based on rough sketches, specifications, and calculations of engineers, architects, and designers. They also calculate the strength, quality, quantity, and cost of materials. Final drawings contain a detailed view of the object as well as specifications for materials to be used, procedures followed, and other information to carry out the job.

In preparing drawings, draftsmen use compasses, dividers, protractors, triangles, and machines that combine the functions of several devices. They also use engineering handbooks, tables, and slide rules to help solve technical problems.

Draftsmen are classified according to the work they do or their level of responsibility. *Senior drafts-*

Draftsmen prepare design layouts.

men translate an engineer's or architect's preliminary plans into design "layouts" (scale drawings of the object to be built). *Detailers* draw each part shown on the layout, and give dimensions, materials, and other information to make the detailed drawing clear and complete. *Checkers* carefully examine drawings for errors in computing or recording dimensions and specifications. Under the supervision of draftsmen, *tracers* make minor corrections and trace drawings for reproduction on transparent cloth, paper, or plastic film.

Draftsmen may specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, or architectural drafting.

Places of Employment

About 327,000 people worked as draftsmen in 1972; almost 8 percent were women. About 9 out of 10 draftsmen work in private industry. Many work in industries making machinery, electrical equipment, and fabricated metal products. In the non-manufacturing sector, most draftsmen work for engineering and architectural consulting firms, construction companies, and public utilities.

Almost 20,000 draftsmen worked for Federal, State, and local governments in 1972. Those in the Federal Government worked mostly for the Defense Department. Draftsmen in State and local governments were mainly in highway and public works departments. Another several thousand draftsmen worked for colleges and universities and non-profit organizations.

Training, Other Qualifications, and Advancement

Persons interested in becoming draftsmen can acquire the necessary training in technical institutes, junior and community colleges, extension divisions of universities, and vocational and technical high schools. Others may qualify through on-the-job training programs combined with part-time schooling or 3- to 4-year apprenticeship programs.

Training for a career in drafting, whether in a high school or post-high school program, should include courses in mathematics, physical sciences, mechanical drawing, and drafting. Shop practices and shop skills also are helpful since many higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, strength of materials, and metal technology.

Those planning careers in drafting should: be able to do detailed work requiring a high degree of accuracy; have good eyesight and eye-hand coordination because most of their work is done at the drawing board; be able to function as part of a team since they work directly with engineers, architects, and skilled workers; and be able to do free-hand drawings of three dimensional objects. Although the occupation generally does not require such artistic ability, it may be helpful in some specialized fields.

High school graduates usually start out as tracers. Those having post-high school technical training often can qualify as junior draftsmen. After gaining experience, they may advance to checkers, detailers, senior draftsmen, or supervisors. Some may become independent designers. Courses in engineering and mathematics sometimes enable draftsmen to transfer to engineering positions.

Employment Outlook

Job opportunities are expected to be favorable through the mid-1980's because of the very rapid growth expected in the occupation and the need to replace those who retire, die, or move into other fields of work. Prospects will be best for those having post-high school drafting training. Well-qualified high school graduates who have studied drafting, however, will find opportunities in some types of jobs.

Employment of draftsmen is expected to rise rapidly as a result of the increasingly complex design problems of modern products and processes. In addition, as engineering and scientific occupations continue to grow, more draftsmen will be needed as supporting personnel. On the other hand, photoreproduction of drawings and expanding use of electronic drafting equipment and computers are eliminating many routine tasks. This development probably will reduce the need for less skilled draftsmen.

Earnings

In private industry, beginning draftsmen earned about $525 a month in 1972 according to a Bureau of Labor Statistics survey. As they gain experience, draftsmen may move to higher level positions with a substantial increase in earnings. For example, in 1972 senior draftsmen averaged $960 a month, about one and one-half times as much as the average earnings of nonsupervisory workers in private industry, except farming. Most draftsmen earned about $800 per month.

In early 1973, the Federal Government paid high school graduates in trainee jobs about $450 a month. For those having post-high school education or some experience in drafting, starting salaries were higher. The majority of experienced draftsmen working for the Federal Government earned between $640 and $800 a month.

Sources of Additional Information

General information on careers for draftsmen may be obtained from:

American Institute for Design and Drafting, 3119 Price Rd., Bartlesville, Okla. 74003.

American Federation of Technical Engineers, 1126 16th St., NW., Washington, D.C. 20036.

See Sources of Additional Information in the statement on Engineering and Science Technicians elsewhere in the *Handbook*.

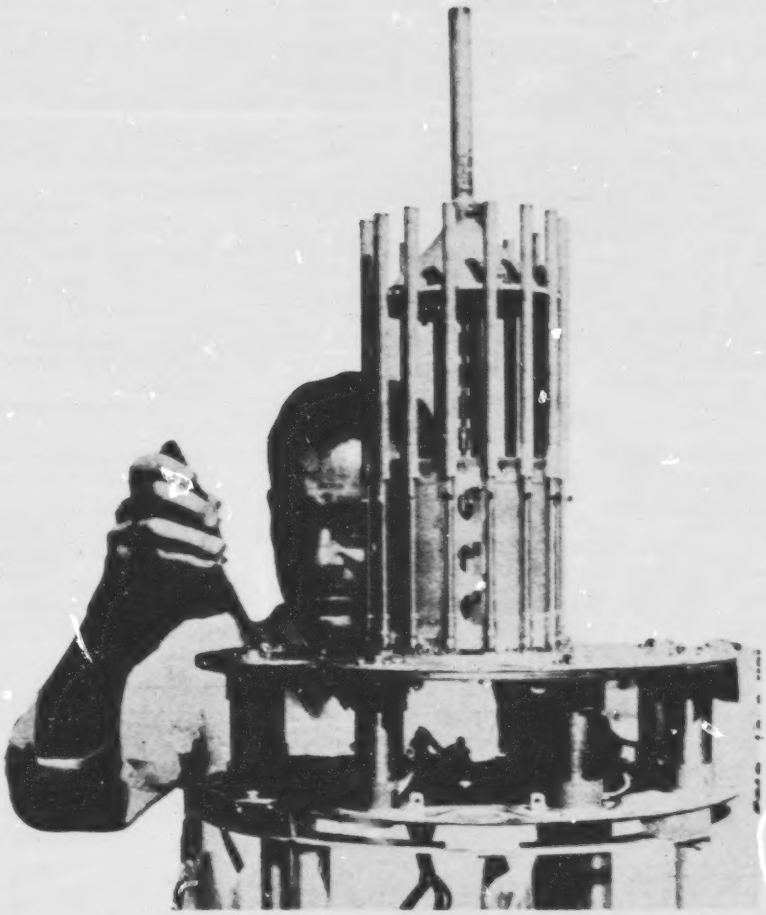
ENGINEERING AND SCIENCE TECHNICIANS

(D.O.T. 002. through 029.)

Nature of the Work

Technicians' knowledge of science, mathematics, industrial machinery, and processes enables them to work in all phases of production, from research and design to manufacturing, sales, and customer service. Although their jobs are more limited and practically oriented than those of engineers or scientists, technicians often do highly technical work that engineers or scientists might otherwise have to do. Technicians frequently use complex electronic and mechanical instruments, experimental laboratory equipment, and drafting instruments. Almost all technicians described in this statement must be able to use engineering handbooks and computing devices such as slide rules and calculating machines.

In research and development (R&D), one of the largest areas of employment, technicians set up, calibrate, and operate complex instruments; analyze computations; and conduct tests. They also assist engineers and scientists in developing experimental equipment and models by making drawings and sketches; and under an engineer's direction they frequently do routine design work.



Technician adjusts experimental antenna equipment.

In production, technicians usually follow the plans and general directions of engineers and scientists, but often without close supervision. They may prepare specifications for materials, devise tests to insure product quality, or study ways to improve the efficiency of an operation. They often supervise production workers to make sure they follow prescribed plans and procedures. As a product is built, technicians check to see that specifications are followed, keep engineers and scientists informed as to progress, and investigate production problems.

As salesmen or field representatives for manufacturers, technicians give advice on installation and maintenance problems of complex machinery, and may write specifications and technical manuals. (See statement on Technical Writers elsewhere in the *Handbook*.)

Job titles of engineering and science technicians may describe the level (biological aid or biological technician), duties (quality

control technician or time study analyst), or area of work (mechanical, electrical, or chemical).

Aeronautical Technology. Technicians in this area work with engineers and scientists to design and produce aircraft, helicopters, rockets, guided missiles, and spacecraft. Many aid engineers in preparing design layouts and models of structures, control systems, or equipment installations by collecting information, making computations, and performing laboratory tests. For example, under the direction of an engineer, a technician might estimate weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians prepare or check drawings for technical accuracy, practicability, and economy.

Aeronautical technicians frequently work as manufacturer's field service representatives, serving as the link between their company and the military, commercial airlines, and other customers. Technicians also prepare technical information for instruction manuals, bulletins, catalogs, and other literature. (See statements on Aerospace Engineers, Airplane Mechanics, and Occupations in Aircraft, Missile and Spacecraft Manufacturing elsewhere in the *Handbook*.)

Air-Conditioning, Heating, and Refrigeration Technology. Air conditioning, heating, and refrigeration technicians design, manufacture, sell, and service equipment to regulate interior temperatures. Technicians in this field often specialize in one area, such as refrigeration, and sometimes in a particular type of activity, such as research and development.

When working for firms that manufacture temperature controlling equipment, technicians generally work in research and engineering departments, where they assist engineers and scientists in the design and testing of new equipment or production methods. For example, a technician may construct an experimental model to test its durability and operational characteristics. Technicians also work as field salesmen for equipment manufacturers or dealers, and must be able to supply engineering firms and other contractors that design and install systems with information on installation, maintenance, operating costs, and the performance specifications of the equipment. Other technicians work for contractors, where they help design and prepare installation instructions for air-conditioning, heating, or refrigeration systems. Still others work in customer service, and are responsible for supervising the installation and maintenance of equipment. (See statement on Refrigeration and Air-Conditioning Mechanics elsewhere in the *Handbook*.)

Chemical Technicians. These technicians work with chemists and chemical engineers to develop, sell, and utilize chemical and related products and equipment.

Most chemical technicians do research and development, testing, or other laboratory work. They often set up and conduct tests on processes and products being developed or improved. For example, a technician may examine steel for carbon, phosphorous, and sulfur content or test a lubricating oil by subjecting it to changing temperatures. The technician measures reactions, analyzes the results of experiments, and records data which will be the basis for decisions and future research.

Chemical technicians in production generally put into commercial operation those products or processes developed in research laboratories. They assist in making the final design, installing equipment, and training and supervising operators on the production line. Technicians in quality control test materials, production processes, and final products to insure that they meet the manufacturer's specifications and quality standards. Many also work as technical salesmen of chemicals or chemical products.

Many chemical technicians use computers and instruments, such as a dilatometer, to measure the expansion of a substance. Because the field of chemistry is so broad, chemical technicians frequently specialize in a particular industry such as food processing or pharmaceuticals. (See statements on Chemists, Chemical Engineers, Food Processing Technicians, and Occupations in the Industrial Chemical Industry elsewhere in the *Handbook*.)

Civil Engineering Technology. Technicians in this area assist civil engineers in planning, designing, and constructing highways, bridges, dams, and other structures. During the planning stage, they may help estimate costs, prepare specifications for materials, or participate in surveying, drafting, or designing. Once construction begins, they may assist the contractor or superintendent in scheduling construction activities or inspecting the work to assure conformance to blueprints and specifications. (See statements on Civil Engineers, Draftsmen, and Surveyors elsewhere in the *Handbook*.)

Electronics Technology. Technicians in this field develop, manufacture, and service a wide range of electronic equipment and systems. They may work with radio, radar, sonar, television, and other communication equipment; industrial and medi-

cal measuring or control devices; navigational equipment; electronic computers, and many other types of electronic equipment. Because the field is so broad, technicians often specialize in one area such as automatic control devices or electronic amplifiers. Furthermore, technological advancement is constantly opening up new areas of work. For example, the development of printed circuits stimulated the growth of micro-miniaturized electronic systems.

When working in design, production, or customer service, electronic technicians use sophisticated measuring and diagnostic devices to analyze and test equipment. In many cases, they must understand the requirements of the field in which the electronic device is being used. In designing equipment for space exploration, for example, they must consider the need for minimum weight and volume and maximum resistance to shock, extreme temperature, and pressure. Electronics technicians also do technical writing and work in technical sales. (See statements on Broadcast Technicians and Occupations in Radio and Television Broadcasting elsewhere in the *Handbook*.)

Industrial Production Technology. Technicians in this area, sometimes called industrial or production technicians, assist industrial engineers on problems involving the efficient use of personnel, materials, and machines to produce goods and services. They prepare layouts of machinery and equipment, plan the flow of work, make statistical studies, and analyze production costs. Industrial technicians also conduct time and motion studies (analyze the time and movements a worker needs to accomplish a job task) to improve the efficiency of an operation.

While working, many industrial technicians acquire experience which enables them to qualify for other jobs. For example, those specializing in machinery and production methods may move into industrial safety. Others, in job analysis, may set job standards and interview, test, hire, and train personnel. Still others may move into production supervision. (See statements on Personnel Workers and Industrial Engineers elsewhere in the *Handbook*.)

Mechanical Technology. Mechanical technology is a broad term which covers a large number of specialized fields including automotive technology, diesel technology, tool design, machine design, and production technology.

Technicians assist engineers in design and development work by making freehand sketches and rough layouts of proposed machinery and other equipment and parts. This work requires knowledge of mechanical principles involving tolerance, stress, strain, friction, and vibration factors. Technicians also analyze the costs and practical value of designs.

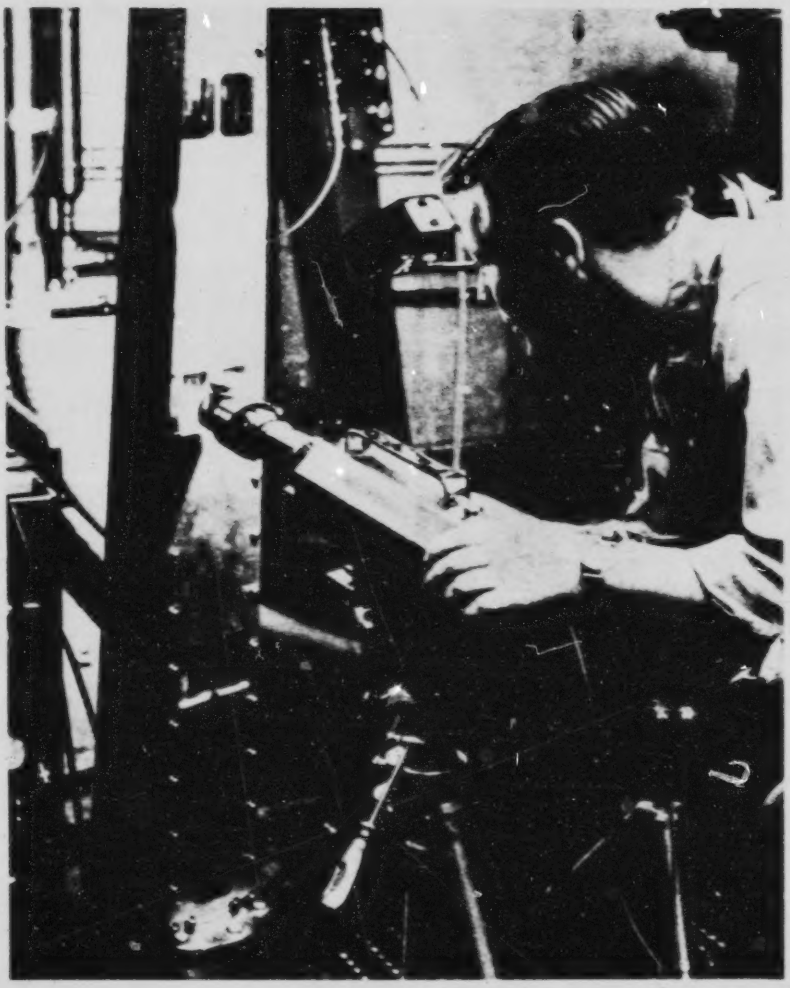
In planning and testing experimental machines and equipment for performance, durability, and efficiency, technicians record data, make computations, plot graphs, analyze results, and write reports. They sometimes recommend design changes to improve performance. Their job often requires skill in the use of instruments, test equipment and gauges, as well as preparation and interpretation of drawings.

When a product is ready for production, technicians help prepare layouts and drawings of the assembly process and parts to be manufactured. They frequently help estimate labor costs, equipment life, and plant space. Some mechanical technicians test and inspect machines and equipment in manufacturing departments or work with engineers to eliminate production problems. Others are technical salesmen.

Tool designers are among the better known specialists in mechanical engineering technology. Tool designers design tools and devices for mass production, and frequently redesign existing tools to improve their efficiency. They prepare sketches of the designs for cutting tools, jigs, dies, special fixtures, and other attachments used in machine operations. They also may make or supervise others in making detailed drawings of tools and fixtures.

Machine drafting, with some designing, is another major area often grouped under mechanical technology and is described in the statement on draftsmen. (See statements on Mechanical Engineers, Automobile Mechanics, Manufacturer's Salesmen, and Diesel Mechanics elsewhere in the *Handbook*.)

Instrumentation Technology. Automated manufacturing and industrial processes, oceanographic and space exploration, weather forecasting, satellite communication systems, environmental control, and medical research have helped to make instrumentation technology a fast-growing field for technicians. They help develop and design complex measuring and control devices such as those in a spacecraft that sense and measure changes in heat or pressure, automatically record data, and make necessary adjustments. These technicians have extensive knowledge of physical sciences as well as electrical-electronic and mechanical engineering. (See statement on Instrument Workers elsewhere in the *Handbook*.)



Technician uses optical tracking instrument to record data.

Technicians also specialize in other fields such as metallurgical (metal), electrical, and optical technology. In the atomic energy field, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination. (See statement on Occupations in the Atomic Energy Field elsewhere in the *Handbook*.) New areas of work include the environmental control field, where technicians study the problems of air and water pollution and industrial safety.

Places of Employment

Over 700,000 persons worked as engineering and science technicians in 1972—12 percent were women. More than 475,000 (about 7 out of 10) worked in private industry. The manufacturing industries employ the largest numbers in the electrical equipment, chemicals, machinery, and aerospace industries. In nonmanufacturing, large numbers worked in wholesale and retail trade, communications, and in engineering and architectural firms.

In 1972, the Federal Government employed over 100,000 technicians chiefly as engineering aids and technicians, equipment specialists, biological technicians, cartographic technicians (map making), meteorological technicians and physical science technicians. The largest number worked for the Department of Defense; most of the others worked for the Departments of Transportation, Agriculture, Interior, and Commerce.

State Government agencies employed over 50,000 engineering and science technicians, and local governments about 11,000. The remainder worked for colleges and universities and nonprofit organizations.

Training, Other Qualifications, and Advancement

Men and women can qualify for technician jobs through many combinations of work experience and education because employers traditionally have been quite flexible in their hiring standards. However, most employers prefer applicants who have had some specialized technical training. Specialized training is available at technical institutes, junior and community colleges, area vocational-technical schools, extension divisions of colleges and universities, and technical-vocational high schools.

Besides academic training, persons can qualify for technician jobs by less formal methods. Workers may learn through on-the-job training programs or courses in post-secondary or correspondence schools. Some qualify from experience in technical jobs in the Armed Forces. Many engineering and science students who have not completed the bachelor's degree and others who have degrees in science and mathematics are able to qual-

ify after additional technical training and experience. Post-secondary training is increasingly necessary for the more responsible jobs and for advancement.

Some of the types of post-secondary and other schools which provide technical training are discussed in the following paragraphs:

Technical Institutes. Technical institutes offer training to qualify students for a job immediately after graduation with only a minimum of on-the-job training. In general, students receive intensive technical training but less theory and general education than in engineering schools or liberal arts colleges. A few technical institutes and community colleges offer cooperative programs; students spend part of the time in school and part in paid employment related to their studies.

Some technical institutes operate as regular or extension divisions of colleges and universities. Other institutions are operated by States and municipalities, or privately.

Junior Colleges and Community Colleges. Curriculums in junior and community colleges which prepare students for technician occupations are similar to those in the freshman and sophomore years of 4-year colleges. After completing the 2-year program graduates can transfer to 4-year colleges or qualify for some technician jobs. Most large community colleges offer 2-year technical programs, and many employers prefer graduates having more specialized training. Junior college courses in technical fields often are planned around the employment needs of the local area.

Area Vocational-Technical Schools. These post-secondary public institutions serve students from surrounding areas and train them for jobs in the local area. Most of these schools require a high school degree or its equivalent for admission.

Other Training. Some large corporations conduct training programs and operate private schools to meet their needs for technically trained personnel in specific jobs; such training rarely includes general studies. Training for some technician occupations, for instance tool designers and electronic technicians, is available through formal 2-to-4 year apprenticeship programs. The apprentice gets on-the-job training under the close supervision of an experienced technician and related technical knowledge in classes, usually after working hours.

The Armed Forces have trained many technicians, especially in electronics. However, military job requirements are generally different from those in the civilian economy. Thus, military technician training may not be adequate for civilian technician work, and additional training may be necessary for employment.

Technician training also is available from many private technical schools that specialize in a single field such as electronics. Some of these schools are owned and operated by large corporations that have the resources to provide very up-to-date training in a technical field. Correspondence schools provide technical training for those who wish to learn more about their job.

Those interested in a career as a technician should have an aptitude for mathematics and science, and enjoy technical work. An ability to do detailed work with a high degree of accuracy is necessary; for design work, creative talent also is desirable. Since technicians are part of a scientific team, they sometimes must work under the close supervision of engineers and scientists as well as with other technicians and skilled workers.

Engineering and science technicians usually begin work as trainees in routine positions under the direct supervision of an experienced technician, scientist, or engineer. As they gain experience, they receive more responsibility and carry out a particular assignment under only general supervision. Technicians may eventually move into supervisory positions. Those who have the ability and obtain additional education are sometimes promoted to science or engineering positions.

Employment Outlook

Employment opportunities for engineering and science technicians are expected to be favorable through the mid-1980's. Opportunities will be best for graduates of post-secondary school technician training programs. Besides the very rapid growth expected in this field, additional technicians will be needed to replace those who die, retire, or leave the occupation.

Industrial expansion and increasing complexity of modern technology underlie the anticipated increase in demand for technicians. Many will be needed to work with a growing number of engineers and scientists in developing, producing, and distributing new and technically advanced products. Automation of industrial processes and growth of new work areas such as atomic energy, environmental control, and urban development will add to the demand for technical personnel.

The anticipated growth of research and development (R&D) expenditures in industry and government should increase demand for technicians. However, this

growth is expected to be slower than in the past because of the anticipated slowdown of the space and defense components of Federal R&D expenditures.

Because space and defense programs are major factors in the employment of technical personnel, expenditures in these areas affect the demand for technicians. The outlook for technicians is based on the assumption that defense spending will be slightly lower than the levels of the late 1960's. If defense spending should differ substantially from this level, the demand for technicians would be affected accordingly.

Earnings

In general, technicians' earnings depend on their education, and technical specialty, as well as their ability and work experience. Other important factors influencing earnings are the type of firm, specific duties, and geographic location.

In early 1973, Federal Government agencies paid beginning engineering and science technicians with an associate degree $6,882; those with a bachelor's degree had starting salaries of $7,694, or $9,520 depending on the type of job vacancy and the applicant's education and other qualifications. Some Federal Government agencies hire and train high school graduates for technician jobs. Beginning salaries for these jobs were $5,432 a year.

Starting salaries in private industry in 1972 for technicians holding associate degrees averaged about $7,700 per year; those with a bachelor's degree averaged almost $10,000 a year.

Most technicians can look forward to an increase in earnings as they move to higher positions. According to a Bureau of Labor Statistics survey, in 1972 annual salaries of workers in responsible technician positions in private industry averaged about $12,000—almost twice as much as the average earnings of nonsupervisory workers in private industry, except farming.

Sources of Additional Information

General information on careers for engineering and science technicians is available from:

American Society for Engineering Education, Suite 400, 1 Dupont Circle, Washington, D.C. 20036

Engineers Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

National Council of Technical Schools, 1835 K St. NW., Room 907, Washington, D.C. 20006.

Information on schools offering technical programs is available from the Engineers Council for Professional Development, a nationally recognized accrediting agency for engineering technology programs; the National Council of Technical Schools; and the U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

State departments of education at each State capital also have information about approved technical institutes, junior colleges, and other educational institutions within the State offering post-high school training for specific technical occupations. Other sources include:

American Association of Junior Colleges, Suite 410, 1 Dupont Circle, Washington, D.C. 20036.

National Home Study Council, 1601 18th St. NW., Washington, D.C. 20009.

National Association of Trade and Technical Schools, 2021 L St., NW., Washington, D.C. 20036.

FOOD PROCESSING TECHNICIANS

(D.O.T. 022.281, 029.381)

Nature of the Work

Unlike man's experience of the past, when food was processed and prepared in the home, much of the food we eat today is processed and prepared by industrial firms and sold at local supermarkets. A relatively small but important number of technicians work for these industrial firms in all areas of food technology, from the development of new products and processing techniques to production, food quality inspection, and marketing.

Titles of technicians in the food processing industry vary from plant to plant, as do technicians' responsibilities. Food processing technicians are known as Laboratory or Quality Assurance Technicians, Physical Science Aides, Plant Facilities Technicians, Biological Aides, Laboratory Analysts, and Research and Development Technicians.

In research and development, food processing technicians assist food scientists in improving existing food products, creating new food items, and developing and improving processes related to production. Duties may include separating and weighing the ingredients of a product and conducting microbiological and chemical analyses of these substances. Technicians also set up samples to test flavor, color, and textural characteristics of foods to insure that they will appeal to consumers. Their work often involves operating and maintaining laboratory equipment such as balances, microscopes, test tubes, and cryoscopes (instruments that determine the freezing point of liquids). Technicians frequently

Food processing technicians help create new food items.

write reports on experiments, tests, and other projects.

In quality assurance laboratories, technicians insure conformity with established industry and government standards by testing both raw ingredients and finished products bacteriologically, chemically, and physically. They may test food samples taken from the production line for bacteria and other possible forms of contamination. Technicians may also examine samples for protein and vitamin content, as well as for color, flavor, and texture, to protect the quality of a product. This work involves the use of equipment such as incubators, color comparison charts, and pH meters (to determine the degree of acidity). Technicians record their findings and sometimes recommend changes in processing techniques.

In production, food processing technicians help supervise processing of food products. They often work closely with fieldmen (company technicians who help farmers produce the best types of food) to insure a steady flow of products from farm to plant. They inspect incoming raw materials to insure suitability for processing and storage under proper conditions. Technicians, working closely with plant managers, recommend measures to improve production methods, equipment performance, and product quality. They also suggest changes in working methods and use of equipment to increase processing efficiency. Some technicians supervise cooking or packaging operations; others are concerned primarily with sanitation in all areas of a food processing plant. They help identify bacterial problems on the line or in the plant, recommend cleaning and sanitizing solutions, and direct cleaning crews.

Technicians in the food processing industry frequently work as manufacturers' technical salesmen providing nutritional and cost information to prospective customers. Many others work as food buyers for supermarket chains where their knowledge of food technology is used to select the best packaged and fresh foods for their companies.

Places of Employment

About 4,500 food processing technicians worked in the food processing industry in 1972. These technicians work for all major food processing firms. Food processing technicians are found in most States; however, the largest numbers are in those States having the heaviest concentration of food processing plants: California, Illinois, Pennsylvania, Texas, Ohio, New Jersey, Wisconsin, Michigan, Iowa, and New York.

Food technicians, in addition to being employed by food processors, may work for State and Federal food inspection agencies, food brokers, and supermarket chains.

(See statement on Health and Regulatory Inspectors elsewhere in the *Handbook*.) Others work in related fields where their specialized training can be utilized—including food packaging companies, food warehousing and transporting companies, and manufacturers of food processing equipment.

Training, Other Qualifications, and Advancement

Men and women who wish to prepare for careers as food processing technicians can obtain the necessary training from a variety of educational institutions, or can qualify for their work on the job. Most employers, however, prefer to hire those who have had some form of specialized training. Formal training programs are offered in post-secondary schools, such as technical institutes, junior and community colleges, and technical divisions of four-year universities. Most schools offering post-secondary technician training require a high school diploma for admittance. Some post-secondary schools admit students on the basis of successful work experience in the food industry and the recommendation of their employer.

Students preparing for careers as food processing technicians should take a year each of biology and chemistry, and two years of mathematics (algebra and geometry) while in high school. Statistics, English, and social science courses also are helpful.

Schools specializing in post-high school technical training offer one, two, and in very few cases, three or four-year programs. The majority are two-year programs leading to an associate of applied science degree. Programs usually include courses in chemistry, microbiology, mathematics, and specialized study of food processing, quality control, packaging, plant and environmental sanitation, and technical report writing. Schools also generally offer elective courses such as accounting, economics, and English.

Curriculums may vary considerably among the schools offering programs in food science technology. Some schools for example, have programs in food processing technology geared towards an individual food processing industry, such as the dairy industry. Many two-year schools require work experience in some phase of the industry between the first and second year, and others suggest that their students obtain this kind of practical experience. The school's placement bureau often assists students in finding this type of employment. Besides providing practical experience, this aids students in paying their tuition expenses and frequently leads to full-time jobs after graduation.

Technicians also can qualify for jobs by completing on-the-job training programs, or through work experience and formal courses taken on a part-time basis. Also, many students from various science disciplines who have not completed all the requirements for a bachelor's degree are able to qualify for technician jobs after obtaining some additional technical training and experience. Although there are many ways to qualify for food processing technician jobs, post-secondary training is increasingly becoming a prerequisite for employment.

In the dairy industry, laboratory technicians must meet licensing requirements in most States. These requirements vary, but generally include a written test.

Food processing technicians generally work as part of a team. Because the quality of processed food affects many people, the food technician must work to exacting standards and be dependable. They are frequently required to make oral or written reports on the results of their work.

Food processing technicians usually begin work as trainees under the direct supervision of an experienced food scientist, and are systematically assigned to jobs throughout the plant. Technicians may begin their careers at a lower level supervisory capacity and, depending on training, ability, and experience, may work up to the mid-management level. Food technicians working in laboratories receive more demanding assignments as they gain experience, and may advance to other positions such as salesmen, purchasing agents or fieldmen.

Employment Outlook

Employment opportunities for food processing technicians are expected to be favorable through the mid-1980's. Many technicians will be needed because of the moderate growth expected in the field and because of the need to replace those who die, retire, or transfer to other occupations. The demand will be strongest for graduates of post-secondary technical training programs.

The public's desire for more convenience foods in the home, and the need for these products by food service institutions are factors underlying the expected increase in demand for food processing technicians. Also, the complexity of processes involved in developing and marketing new food products will create a need for more technicians. This need will be especially critical in quality assurance areas, as higher quality and safety stand-

ards are set and as more technical supervision in processing become necessary. Many smaller processing firms, which currently operate without the aid of technicians, are expected to require them in the future.

Earnings

In general, technicians' earnings depend on their education, ability, and work experience. Other important factors are the type of firms for which they work, their specific duties, and the geographic location of their jobs. Beginning food processing technicians had average starting salaries of $7,300 a year in 1972, according to limited data. Most technicians can look forward to an increase in earnings as they gain experience and advance to higher level positions.

Sources of Additional Information

For further information regarding careers as food processing technicians, students should contact their school counselors for help in locating technical institutes, junior and community colleges, and universities offering programs in food processing technology. (See Sources of Additional Information in the statement on Engineering and Science Technicians elsewhere in the *Handbook*.)

SURVEYORS

(D.O.T. 018.188)

Nature of the Work

Before engineers can plan a highway or other building projects, they need complete and accurate information about boundaries, land features, and other physical characteristics of the construction site. Surveyors measure construction sites, help establish official land boundaries, assist in setting land valuations, and collect information for maps and charts.

Surveyors (sometimes called party chiefs) are in charge of a field party that determines the precise measurements and locations of elevations, points, lines, and contours on the earth's surface, and distances between points. Surveyors are directly responsible for the field party's activity and the accuracy of their work. They plan the field work, select survey reference points, and determine the precise location of natural and man-made features of the survey region. They record the information disclosed by the survey, verify the accuracy of the survey data, and prepare sketches, maps, and reports.

A typical field party is made up of the surveyor and three to six other workers. *Instrumentmen* adjust and operate surveying instruments such as the theodolite (used to measure horizontal and vertical angles), and the altimeter (used to measure altitude). *Chainmen* use a steel tape or surveyor's chain to measure distances between surveying points. Generally chainmen work in pairs, one holding the head end of the tape to establish the most advanced measuring point and the other holding the rear end of the tape at the last established point. Chainmen also may mark measured points with painted stakes. *Rodmen* use a level rod, range pole, or other equipment to assist instrumentmen in determining elevations, distances, and directions. They hold and move the range pole according to hand or verbal signals of an instrumentman to help establish the exact point of measurement. Rodmen also may clear brush from the survey line.

Surveyors often specialize in a particular type of survey. Besides doing *highway surveys*, many perform *land surveys* and locate boundaries of a particular tract of land. They then prepare maps and legal descriptions for deeds, leases, and other documents. Surveyors doing *topographic surveys* determine elevations, depressions, and contours of an area, and indicate the location of distinguishing surface features such as farms, buildings, forests, roads, and rivers.

Several closely related occupations are geodesy and photogrammetry. Geodesists measure immense areas of land, sea, or space by taking into account the earth's curvature and its geophysical characteristics. (See statement on Geophysicists elsewhere in the *Handbook*.) Photogrammetrists measure and interpret natural or man-made features of an area and make topographic maps by applying analytical processes and mathematical techniques to photographs obtained from aerial or ground surveys.

Places of Employment

About 58,000 people worked as surveyors in 1972; less than 5 percent were women.

Federal, State, and local government agencies employ almost one-third of all surveyors. Among the Federal Government agencies employing these workers are the U.S. Geological Survey, the Bureau of Land Management, the Army Corps of Engineers, and the Forest Service. Surveyors in State and local government agencies work mainly for highway departments and urban planning and redevelopment agencies.

A large number of surveyors work for construction companies

and for engineering and architectural consulting firms. A sizable number either work for or own firms that conduct surveys for a fee. Significant numbers of surveyors also work for crude-petroleum and natural gas companies, and for public utilities.

Training, Other Qualifications, and Advancement

A combination of post-secondary school courses in surveying and extensive on-the-job training is the most common method of entering surveying work. Junior colleges, technical institutes, and vocational schools offer 1, 2, and 3-year programs in surveying. Most surveying programs admit only high school graduates, preferably those who studied algebra, geometry, trigonometry, calculus, drafting, and mechanical drawing. With some post-secondary school courses in surveying, beginners generally start as instrumentmen. After gaining experience, they usually advance to party chief or surveyor. In many instances, promotions to higher level positions are based on written examinations as well as experience.

High school graduates with no formal training in surveying usually start as rodmen. After several years of on-the-job experience and some formal training in surveying, it is possible to advance to chainman, instrumentman, and finally to surveyor.

For those interested in a professional career in photogrammetry, a bachelor's degree in engineering or the physical sciences is usually needed.

All 50 States require licensing or registration of land surveyors responsible for locating and describing land boundaries. In some of these States, applicants for licenses need to know other types of surveying in addition to land surveying. Requirements vary among the States but in general include a combination of 4 to 8 years' experience in surveying and passing an examination. Most States reduce the length of experience needed to take the licensing examination if the applicant has taken post-secondary courses in surveying.

In 1972, about 19,500 land surveyors were registered. In addition, about 16,000 engineers were registered to do land surveying, primarily as part of their civil engineering duties; however, these workers are considered engineers rather than surveyors. (See statement on Civil Engineers elsewhere in the *Handbook*.)

Qualifications for success as a surveyor include an ability to visualize objects, distances, sizes, and other abstract forms and to make mathematical calculations quickly and accurately. Leadership qualities also are important as surveyors must supervise the work of others.

Members of a survey party must be strong and healthy to work outdoors and carry equipment over difficult terrain. They also need good eyesight, coordination, and hearing to communicate over great distances by hand signals or voice calls.

Employment Outlook

Employment opportunities for surveyors are expected to be good through the mid-1980's, especially for those with post-secondary school training. In addition to the openings resulting from the very rapid

Surveyors work in all types of terrain.

growth expected for the field, others will be needed to replace those who die, retire, or transfer to other fields of work.

The rapid development of urban areas and increased land values should create jobs for surveyors to locate boundaries for property records. Others will be needed to lay out streets, shopping centers, schools, and recreation areas. Construction and improvement of the Nation's roads and highways also will require many new surveyors.

Earnings and Working Conditions

In the Federal Government in early 1973, high school graduates with little or no training or experience started as rodmen or chainmen with an annual salary of $5,432, and $6,128 for those with one-year of related post-secondary training. Those with an associate degree and courses in surveying generally started as instrumentmen with an annual salary of $6,882. Starting salaries for people who had enough experience and training to qualify as a party chief or surveyor ranged from $8,572 to $9,520 per year. The majority of party chiefs in the Federal Government earned between $8,000 and $11,000 per year and some surveyors in high level positions earned more than $14,000 per year.

Although salaries vary by geographic area, limited data indicate that salaries in private industry are generally comparable to those in Federal service and above the average earnings of nonsupervisory workers in private industry, except farming. Surveyors in private practice averaged $12,000 a year in small limited practices and much greater amounts in large diversified practices.

Surveyors usually work an 8-hour, 5-day week. However, they sometimes work longer hours during the summer months when weather conditions are most suitable for surveying. The work of surveyors is active and sometimes strenuous. They may stand for long periods and walk long distances or climb mountains with heavy packs of instruments and equipment. Because most work is out-of-doors, surveyors may be exposed to all types of weather. Some duties, such as planning surveys, preparing reports and computations, and drawing maps usually are done in an office.

Sources of Additional Information

Information about training and career opportunities in surveying is available from:

American Congress on Surveying and Mapping, Woodward Building, 733 15th St. NW., Washington, D.C. 20005.

General information on careers in photogrammetry is available from:

American Society of Photogrammetry 150 North Virginia Ave., Falls Church, Va. 22046.

MECHANICS AND REPAIRMEN

Mechanics and repairmen—the workers who keep our automobiles, airplanes, household appliances, and other machinery operating properly—make up one of the fastest growing groups of skilled workers in the Nation's labor force. This occupational field offers many career opportunities to young people who are mechanically inclined and are willing to invest a few years in learning a trade.

Nearly 2.8 million people worked as mechanics and repairmen in 1972. More than one-third were automotive mechanics, such as automobile mechanics, truck or bus mechanics, and automobile body repairmen. Some other large occupations—each employing more than 100,000 workers—were appliance servicemen, industrial machinery repairmen, aircraft mechanics, and television and radio service technicians. Employment in some occupations, including those of vending machine mechanic, electric sign serviceman, and locksmith, was relatively small.

In addition to the nearly 2.8 million mechanics and repairmen employed in 1972, about 600,000 people worked in three related occupations: maintenance electrician, telephone craftsworker, and watch repairman. Altogether these 3.4 million maintenance and repair workers represented about 3 out of every 10 skilled workers.

Nearly three-tenths of the mechanics and repairmen worked in manufacturing industries, and the majority of these were in plants that produce durable goods such as steel, automobiles, and aircraft. About one-fifth of the mechanics and repairmen worked in retail trade—mainly in firms that sell and service automobiles, household appliances, farm implements, and other mechanical equipment. Another one-fifth worked in shops that service such equipment. Most of the remaining mechanics and repairmen worked for transportation, construction, and public utilities industries, and the government at all levels.

Mechanics and repairmen work in every section of the country. Most employment opportunities, however, are in the populous and industrialized States.

Training, Other Qualifications, and Advancement

Many mechanics and repairmen learn their skills on the job or through apprenticeship training. Some acquire basic training or increase their skills in vocational and technical schools. Others take correspondence courses. Training and experience in the Armed Forces also may help young people prepare for occupations such as aircraft mechanic and television and radio serviceman.

Most employers consider a 3-to-4 year apprenticeship, supplemented each year by at least 144 hours of related classroom instruction, as the best way to learn skilled maintenance and repair work. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Employers look for applicants who have mechanical aptitude and

like to work with their hands. Many employers prefer people whose hobbies or interests include automobile repair, model building, or radio and television repair. A high school education often is required, and employers prefer applicants who have had courses in mathematics, chemistry, physics, blueprint reading, and machine shop. Generally, trainees must be at least 18 years old.

Physical requirements for work in this field vary greatly. For example, telephone linemen should be strong and agile, to climb poles, lift heavy equipment, and work in awkward positions. On the other hand, instrument and watch repairmen need patience, finger dexterity, and good vision.

Many maintenance and repair workers advance to foreman, maintenance, or service manager; others to sales, technician, or technical writing jobs. Many open their own businesses.

Employment Outlook

Employment in maintenance and repair occupations as a whole is expected to increase rapidly through the mid-1980's. In addition to jobs created by employment growth, openings will arise as experienced workers retire, die, or transfer to other fields.

Many factors are expected to contribute to the growing need for mechanics and repairmen, including increased demand for household appliances, automobiles, and other items, and repair of complex machinery in industry.

This chapter includes statements on many maintenance and repair occupations. Other maintenance and repair workers are discussed in other sections of the *Handbook*. For example; aircraft mechanics are discussed with Air Transportation Occupations and millwrights with Industrial Production and Related Occupations.

TELEPHONE CRAFT OCCUPATIONS

About one out of every three employees in the telephone industry is a craft worker who installs, repairs, and maintains phones, cables, and related equipment. This chapter discusses the four groups of telephone craft occupations: central office craft occupations, central office equipment installers, linemen and cable splicers, and telephone servicemen.

CENTRAL OFFICE CRAFT OCCUPATIONS

Nature of Work

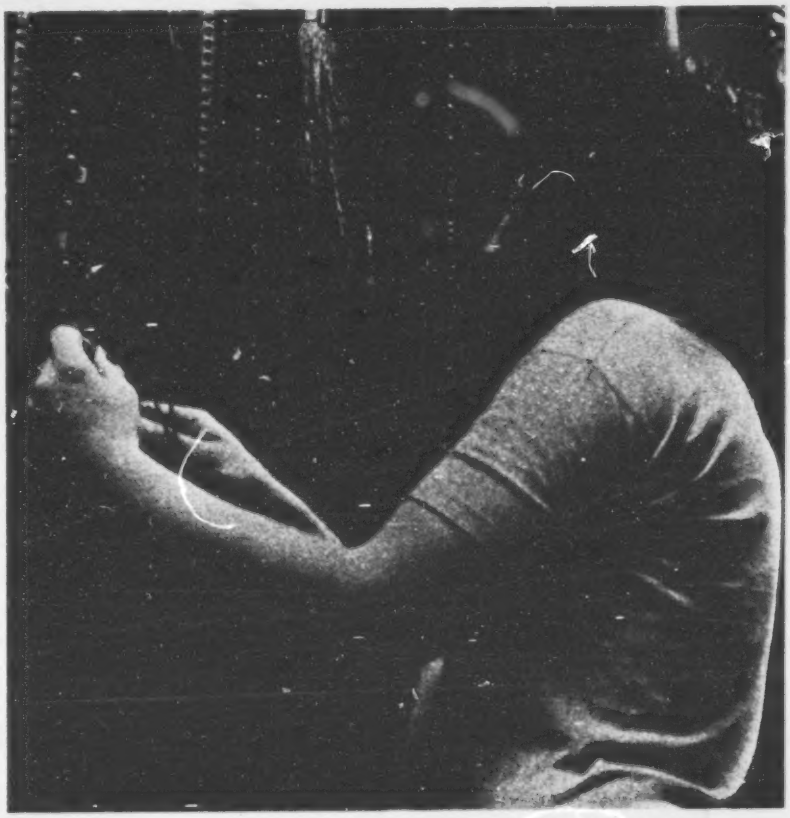
Telephone companies employed about 105,000 craft workers in 1972 to maintain and repair the complex equipment in their central offices. Most worked as framemen, repairmen, and testboardmen.

Framemen (D.O.T. 822.884) connect and disconnect wires that run from telephone lines and cables to equipment in central offices. They make these changes when new phones are installed, existing ones are removed, or numbers are changed. *Central office repairmen* (D.O.T. 822.281), often called *switchmen*, maintain the switching equipment that automatically connects lines when customers dial numbers. *Testboardmen* (D.O.T. 822.281) work at special switchboards to locate and analyze trouble spots reported on customers' lines. They also work with other employees, such as central office repairmen and cable splicers, who help find the cause of trouble and make repairs.

Training, Other Qualifications, and Advancement

Telephone companies give classroom instruction and on-the-job training to new central office craft employees. Trainee jobs are filled by employees already with the company, such as telephone operators, and by workers hired from outside. Usually, trainees are assigned to the starting job of frameman, take basic courses in telephone communications, and gain practical experience by observing and helping experienced framemen under the direction of supervisors. With additional training and experience, a frameman can advance to central office repairman or testboardman. At least 5 years usually are necessary for an inexperienced worker to advance to the top pay rate in either of these two jobs.

Young persons who are considering careers in central office crafts should have good eyesight—no color blindness. They also should be able to work closely with others because teamwork often is essential in solving complex maintenance problems. A basic knowledge of electricity and electronics and telephone training in the armed services are helpful. Usually aptitude tests



Central office repair person checks and repairs switching equipment.

are given to prospective employees.

Telephone companies give central office craft employees continued training throughout their careers to keep them abreast of the latest developments. As new types of equipment and tools and new maintenance methods are introduced, they are sent to schools for courses of varying duration.

Central office craft workers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment in central office craft occupations is expected to increase moderately through the mid-1980's, mainly to meet the growing demand for telephone service and data communication systems. In addition to employment growth, many job openings will arise to replace experienced workers who retire, die, or transfer to other occupations. Retirements and deaths alone may result in several thousand openings each year.

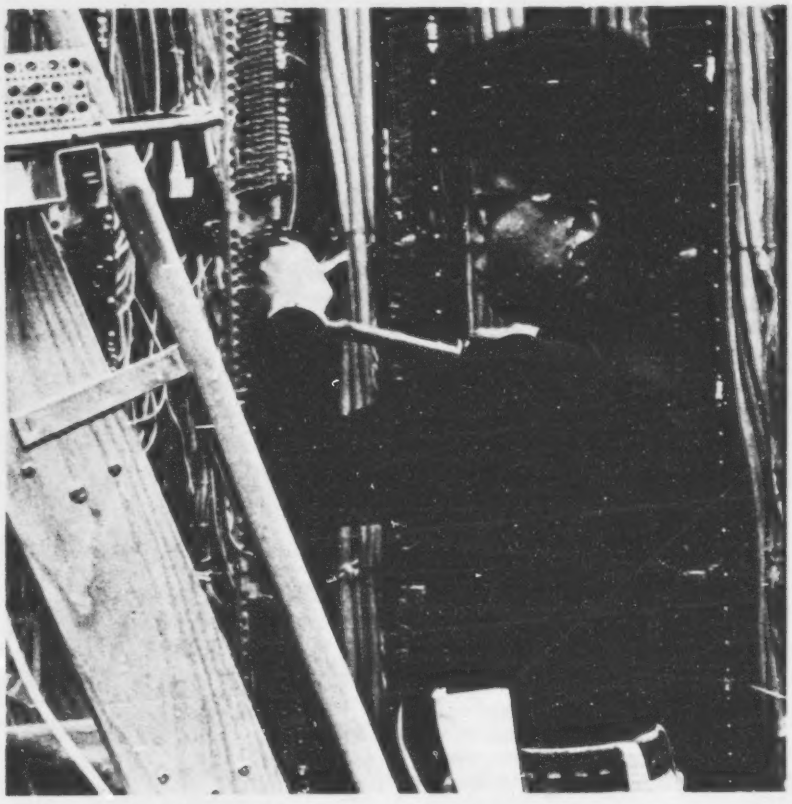
Earnings and Working Conditions

In early 1972, average hourly rates in large telephone companies were $4.85 for testboardmen and $4.52 for central office repairmen. The latter figure was nearly one-fourth higher than the average for nonsupervisory workers in all private industries, except farming.

Earnings increase considerably with length of service. According to a 1972 union contract in one of the higher pay scale cities, framemen start at $3.50 an hour and can work up to a maximum of $4.91 an hour after 4 years. Central office repairmen and testboardmen can earn a maximum of $5.88 an hour after 5 years.

Employees in central offices work in clean and well-lighted surroundings. Since the telephone industry gives continuous service to its customers, central offices operate 24 hours a day, 7 days a week. Some central office craft workers, therefore, have work schedules for which they receive extra pay. Central office craft workers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on supplementary benefits.



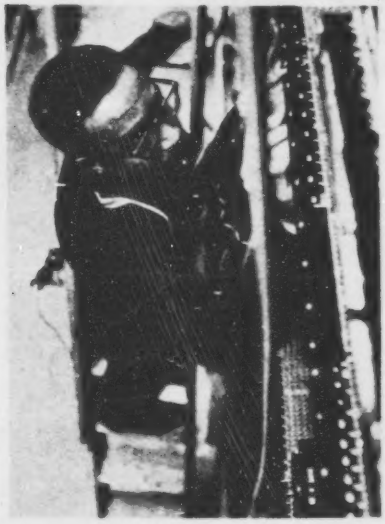
CENTRAL OFFICE EQUIPMENT INSTALLERS

Nature of the Work

Central office equipment installers set up complex switching and dialing equipment in central offices of telephone companies. They assemble, wire, adjust, and test this equipment to meet manufacturer's standards for efficiency and dependability. They may install equipment in a new central office, add equipment in an expanding office, or replace outmoded equipment.

About 30,000 installers were employed in 1972. Most work for manufacturers of central office equipment. Others work directly for telephone companies or for private contractors who specialize in large-scale installations.

Many central office equipment



Central office equipment installer wires switching equipment.

installers are assigned to areas that include several States, and therefore, must travel frequently. When installing a switchboard in a small community, an installer may work with only one or two other installers. On large jobs, however, such as a long-distance toll center in a big city, hundreds of installers are required.

Training, Other Qualifications, and Advancement

Individuals considering careers as central office equipment installers should have good eyesight—no color blindness. They should be able to work with others, for teamwork is often essential to solving a complex problem. Applicants usually must pass aptitude tests and a physical examination.

New employees receive on-the-job training and classroom instruction. They attend classes the first few weeks to learn basic installation methods before starting on-the-job training. After several years of experience, they may qualify as skilled installers. Training, however, continues even after they become skilled. Additional courses are given from time to time to improve their skills, and to teach new techniques in installing telephone equipment.

Installers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment of central office equipment installers is expected to increase moderately through the mid-1980's. In addition to the job openings that will result from employment growth, a few hundred openings will arise each year to replace experienced installers who transfer to other work, retire, or die.

Employment will increase because of the need to install equipment in thousands of new telephone central offices and to replace obsolete equipment. Employment may, however, fluctuate from year to year with changes in business conditions. When the business outlook is depressed, there is less likelihood that new central offices will be built and existing offices enlarged or modernized. When business is prospering, installations and modifications of central offices may occur at an above-average pace.

Earnings and Working Conditions

According to a major union contract in 1972 starting rates for inexperienced installers ranged from $3.25 to $3.75 an hour. The contract provided for periodic increases, and employees could reach rates of $4.93 to $5.58 an hour after 5 years of experience. Travel and expense allowance also are provided.

Time and a half is paid for work over 8 hours a day or 40 hours a week, and double time is paid for Sundays and two and one-half times for holidays. Depending on locality, installers receive 9 to 11 paid holidays a year. Length of service determines paid vacations.

The Communications Workers of America represents most central office equipment installers, including those with the Bell System. The International Brotherhood of Electrical Workers represents some installers employed by the New England Telephone and Telegraph Company, by manufacturers supplying the independent segment of the telephone industry, and by large installation contractors.

LINEMEN AND CABLE SPLICERS

Nature of the Work

The vast network of wires and cables that connect telephone central offices to each other and to customers' telephones and switchboards is constructed and maintained by linemen and cable splicers and their helpers. Telephone companies employed about 50,000 of these workers in early 1972; 15,000 linemen, 31,000 cable splicers, and 4,000 helpers, laborers, and other workers.

To construct new telephone lines, *linemen* (D.O.T. 822.381) place wires and cables that lead from the central office to customers' premises. They use power-driven equipment to dig holes and set in telephone poles which support cables. Linemen climb the poles to attach the cables, usually leaving the ends free for cable splicers to connect later. In cities where telephone lines are below the streets, linemen place cables in underground conduits. Construction linemen usually work in crews of two or more persons.

A foreman directs the work of several crews.

When wires or cables break or a pole is knocked down, linemen make emergency repairs. The line crew foreman keeps in close contact with the central office, which directs the crew to problem locations on the lines. Some linemen periodically inspect sections of lines in rural areas and make minor repairs.

After linemen place cables on poles or underground, *cable splicers* (D.O.T. 829.381) generally complete the line connections. Splicers work on poles, aerial ladders and platforms, in manholes, or in basements of large buildings. They connect individual wires within the cable and rearrange wires when lines have to be changed. At each splice, they either wrap insulation around the wires and seal the joint with a lead sleeve, or cover the splice with some other type of closure. Sometimes, they fill the cable sheathing with compressed air to keep out moisture. Splicers also maintain and repair cables. The preventive maintenance work that they do is extremely important, because a single defect in a cable may cause a serious interruption in service. Many trouble spots are located through air pressure or electric tests.

Training, Other Qualifications, and Advancement

Telephone companies hire inexperienced workers to train for jobs as linemen or cable splicers. Knowledge of the basic principles of electricity and telephone training in the armed services are helpful. Aptitude tests usually are given to prospective employees. Some line and cable work is strenuous, requiring workers to climb poles and lift lines and equipment. Applicants must be physically qualified for such work. The ability to distinguish color also is important because wires usually are coded by color.

Telephone companies have training programs for linemen and cable splicers that include classroom instruction as well as on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, cable supporting clamps, and other fixtures to simulate working conditions as closely as possible. Trainees learn to climb poles and are taught safe working practices to avoid falls and contact with power wires. After a short period of classroom training, some trainees are assigned to a crew to work with experienced linemen and cable splicers under the supervision of a line foreman.

Linemen and cable splicers continue to receive training throughout their careers, to qualify for more difficult assignments and to keep up with technological changes. Those having the necessary qualifications find many additional advancement opportunities in the telephone industry. For example, a lineman may be transferred to telephone installer and later to telephone repairman or other higher rated jobs.

Employment Outlook

Employment of cable splicers

is expected to grow moderately through the mid-1980's. Although technological developments such as the telephone splicing van which uses the power of the truck engine to heat and ventilate manholes and drive power tools and equipment will improve the efficiency of these workers, more will have to be hired to keep pace with the continued high levels of activity in cable installation and maintenance. In addition to the job openings from employment growth, many openings will arise to replace experienced cable splicers who retire, die, or transfer to other occupations.

Little or no change is expected in the number of linemen because the increasing use of mechanical improvements, such as plows that can dig a trench, lay cable, and cover it in a single operation, have eliminated much of the heavier physical work of the line crews and have caused reductions in crew size. Some job openings will occur, however, as experienced linemen retire, die, or transfer to other occupations.

Earnings and Working Conditions

In early 1972, cable splicers wage rates averaged $4.43 an hour and linemen's averaged $3.88. By comparison, nonsupervisory workers in all private industries, except farming, averaged $3.55 an hour.

Pay rates for cable splicers and linemen depend to a considerable extent upon length of service and geographic location. For example, according to a 1972 union contract, new workers in line construction jobs in one of the higher pay scale cities began at $3.50 an hour. Linemen could reach a maximum of $5.80 after 5 years of service. The maximum hourly rate for cable splicers was $5.88. Linemen and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Linemen and cable splicers work outdoors. They must do considerable climbing, and often work in stooped and cramped positions. Safety standards, developed over the years by telephone companies with the cooperation of labor unions, have greatly reduced the hazards of these occupations. When severe weather damages telephone lines, linemen and cable splicers may be called upon to work long and irregular hours to restore service. Because of the physical demands of the work, some linemen and cable splicers, by the time they reach their mid-fifties, transfer to other jobs such as telephone installers and repairmen or central office craft occupations.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on supplementary benefits.

TELEPHONE SERVICEMEN

Nature of the Work

Telephone servicemen are the largest group of telephone craft workers; nearly 110,000 were employed in 1972. They install and service telephones and switchboard systems such as PBX and CENTREX on the customers' property and make necessary repairs on the equipment when trouble develops. These workers generally travel to customers' homes and offices in trucks equipped with telephone tools and supplies. When customers move or request new types of service, they relocate telephones or make changes on existing equipment. For example, they may install a switchboard in an office, or change a two-party line to a single-party line in a residence. Installers also may fill a customer's request to add an extension in another room, or to replace an old telephone with a new model. Although some servicemen do a variety of work, most specialize in one or two jobs described below.

Telephone installers (D.O.T. 822.381) install and remove telephones in homes and business places. They connect telephones to outside service wires and sometimes must climb poles to make these connections. Telephone installers are sometimes called station installers.

PBX installers (D.O.T. 822.381) perform the same duties as telephone installers, but they specialize in more complex telephone system installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers also set up equipment for radio and television broadcasts, mobile radiotelephones, and data equipment.

Telephone repairmen (D.O.T. 822.281), with the assistance of testboardmen in the central office,

locate trouble on customers' equipment and make repairs to restore service.

PBX repairmen (D.O.T. 822.281), with the assistance of testboardmen, locate trouble on customers' PBX, CENTREX or other complex telephone systems and make the necessary repairs. They also maintain associated equipment such as batteries, relays, and power plants. Some PBX repairmen maintain and repair equipment for radio and television broadcasts, mobile radiotelephones, and data equipment.

Training, Other Qualifications, and Advancement

Telephone companies give new service workers classroom instruction and on-the-job training. They train inexperienced people as well as their own employees, such as telephone operators for telephone installation and repair jobs. Applicants need good eyesight—no color blindness. Tests are given to help determine the applicant's aptitude for the work. Companies train experienced employees, such as telephone installers and repairmen and cable splicers, for PBX installation and repair work.

Classroom training usually is designed to simulate actual working conditions. For example, telephone installer trainees are instructed in classrooms equipped with telephone poles, lines and cables, terminal boxes, and other equipment. They practice installing telephones and connecting wires just as they would in the field. After a few weeks in the classroom, trainees are assigned to the field for on-the-job training by experienced workers.

Telephone service workers continue to receive training throughout their careers, to qualify for more responsible assignments and to keep up with technical changes. Those who have managerial ability can advance to supervisory jobs.

Employment Outlook

Employment of telephone servicemen is expected to increase moderately through the mid-1980's. In addition to the jobs that will result from employment growth, many openings will arise to replace workers who retire, die, or transfer to other occupations. Some of these openings may be filled by workers from other telephone jobs, such as operators, service representatives, linemen, or cable splicers, but many will be available to new employees.

Employment will increase due to the growing demand for telephones, and PBX and CENTREX systems. However, technological changes that have increased the efficiency of servicemen will limit the employment increase. Examples of such changes include improved designs for telephone instruments, wires, and cables and the development of removable components which can be returned to the factory or service shop for repair.

Earnings and Working Conditions

In early 1972, the average hourly rate for PBX repairmen was $4.66 and the average for telephone and PBX installers was $4.36. In comparison, nonsupervisory workers in all private industries, except farming, had average earnings of $3.55 an hour.

Earnings increase considerably with length of service. According to a 1972 union contract in one of the higher pay scale cities, telephone servicemen have a starting rate of $3.50 an hour, with periodic pay increases until a maximum of $5.80 an hour is reached after 5 years. Servicemen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Telephone servicemen work indoors and outdoors in all kinds of weather. They may work extra hours when breakdowns occur in lines or equipment.

(See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on supplementary benefits.)

OTHER MECHANICS AND REPAIRMEN

AIR-CONDITIONING, REFRIGERATION, AND HEATING MECHANICS

(D.O.T. 637.281 and .381, 862.281 and .381, and 869.281)

Nature of the Work

Air-conditioning, refrigeration, and heating mechanics work on cooling and heating equipment used in homes, offices, schools, and other buildings. Major occupations in these fields are those of air-conditioning and refrigeration mechanic, furnace installer, oil burner mechanic, and gas burner mechanic. Many workers are skilled in more than one of these trades.

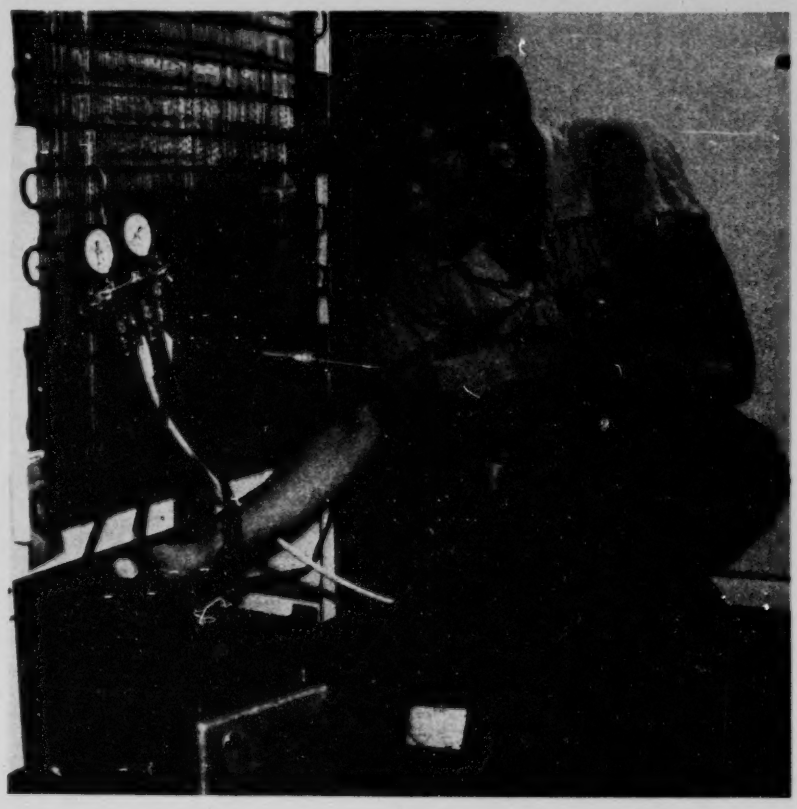
Air-conditioning and refrigeration mechanics (D.O.T. 637.281 and .381) install and repair equipment ranging in size from small window units to large central air-conditioning or refrigeration systems. When installing new equipment, they put the motors, compressors, evaporators, and other components in place, following blueprints and design specifications. They connect duct work, refrigerant lines, and other piping and then connect the equipment to an electrical power source. After completing the installation, they charge the system with refrigerant and check it for proper operation.

When air-conditioning and refrigeration equipment breaks down, mechanics diagnose the cause and make necessary repairs. When looking for defects they inspect components such as relays and thermostats.

Furnace installers (D.O.T. 862.381 and 869.281), also called heating equipment installers, follow blueprints or other specifications to install oil, gas, and electric heating units. After setting the heating unit in place, they install fuel supply lines, air ducts, pumps, and other components. They then connect electrical wiring and controls, and check the unit for proper operation.

Oil burner mechanics (D.O.T. 862.281) keep oil-fueled heating systems in good operating condition. During the fall and winter, they service and adjust oil burners. Mechanics determine the reason a burner is not operating properly by checking the thermostat, burner nozzles, controls, and other parts. Mechanics carry replacement parts in their trucks to make repairs in the customer's home or place of business. However, if major repairs are necessary, they usually complete the repairs in the shop. During the summer, mechanics service heating units, replace oil and air filters, and vacuum-clean vents, ducts, and other parts of the heating system that accumulate soot and ash.

Gas burner mechanics (D.O.T. 637.281), also called gas appliance servicemen, have duties similar to those of oil burner mechanics. They diagnose malfunctions in gas-fueled



Refrigeration mechanic attempts to locate leak with gages and meters.

heating systems and make necessary repairs and adjustments. They also repair cooking stoves, clothes dryers, and hot water heaters. During the summer, mechanics employed by gas utility companies may inspect and repair gas meters.

Air-conditioning, refrigeration, and heating mechanics use a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, and acetylene torches. They also use volt meters, electronic circuit testers, and other testing devices.

Cooling and heating systems sometimes are installed or repaired by other craftsmen. For example, on a large air-conditioning installation job, especially where workers are covered by union contracts, duct work might be done by sheet-metal workers; electrical work by electricians; and installation of piping, condensers, and other components by pipefitters. Appliance servicemen often install and repair window air conditioners. Additional information about these occupations appears elsewhere in the *Handbook*.

Places of Employment

An estimated 135,000 air-conditioning, refrigeration, and heating mechanics were employed in 1972. These workers were employed primarily by cooling and heating dealers and contractors. Fuel oil dealers employ most oil burner mechanics, and gas utility companies employ most gas burner mechanics.

Air-conditioning and refrigeration mechanics and furnace installers work in all parts of the country. Generally, the geographic distribution of these workers is similar to that of our population. Oil burner mechanics are concentrated in States where oil is a major heating fuel. More than half of these workers are employed in New York, Massachusetts, Pennsylvania, New Jersey, Connecticut, and Illinois. Similarly, gas burner mechanics are concentrated in States where gas is a major heating fuel. More than half of these workers are employed in California, Texas, Ohio, Illinois, Michigan, Pennsylvania, and New York

Training, Other Qualifications, and Advancement

Most air-conditioning, refrigeration, and heating mechanics start as helpers and acquire their skills by working for several years with experienced mechanics. Beginners perform simple tasks, such as insulating refrigerant lines or cleaning furnaces. As helpers gain experience, they are given progressively more complicated tasks, such as installing pumps and burners and checking circuits.

Employers prefer high school graduates who have had courses in mathematics, physics, and blueprint reading. Mechanical aptitude and an interest in electricity also are important qualifications. Good physical condition helps in lifting and moving heavy equipment.

Many high school and vocational schools cooperate with local employers and organizations such as the Air-Conditioning and Refrigeration Institute and the National Oil Fuel Institute in offering basic mechanics courses. These courses may last from 2 to 3 years and consist of on-the-job training and classroom instruction. In 1972, unemployed and underemployed workers were trained in programs lasting up to a year in many cities under the Manpower Development and Training Act. Additional on-the-job training and experience is needed to qualify these students as skilled mechanics.

Employment Outlook

Employment of air-conditioning, refrigeration, and heating mechanics is expected to increase very rapidly through the mid-1980's. In addition to jobs resulting from employment growth, many job openings will occur because of the need to replace experienced mechanics who transfer to other fields of work, retire, or die.

Most new openings will be for air-conditioning and refrigeration mechanics. Increases in household formations and rising personal incomes should result in a very rapid increase in the number of air-conditioned homes. Air-conditioning in offices, stores, hospitals, schools, and other buildings also is expected to increase. In addition, more refrigeration equipment will be neded in the production, storage, and marketing of food and other perishables.

Employment of furnace installers and gas burner mechanics is expected to follow the rapid growth trends in the construction of homes and businesses. Employment of oil burner mechanics, on the other hand, is expected to remain fairly stable, since relatively few new homes are being built with oil heating systems.

Earnings and Working Conditions

Hourly rates for skilled air-conditioning, refrigeration, and heating mechanics ranged from about $4 to $8.50 in 1972, according to the limited information available. Skilled mechanics generally earned between two and three times as much as did inexperienced helpers. Mechanics who worked on both air-conditioning and heating equipment frequently had higher rates of pay than those who worked on only one type of equipment.

Most mechanics work a 40-hour

week. However, during seasonal peaks they often work overtime or irregular hours. Air-conditioning and refrigeration mechanics are busiest during spring and summer, and heating mechanics are busiest during fall and winter. Most employers try to provide a full workweek the year round, but they may temporarily reduce hours or lay off some mechanics when seasonal peaks end. However, employment in most shops that service both air-conditioning and heating equipment is fairly stable throughout the year.

Mechanics sometimes are required to work at great heights when installing new equipment. They also may work in awkward or cramped positions. Hazards in this trade include electrical shock, torch burns, muscle strains, and other injuries that may result from handling heavy equipment.

Sources of Additional Information

For more information about employment opportunities, contact the local office of the State employment service or firms that employ air-conditioning, refrigeration, and heating mechanics. The State employment service also may have information about opportunities available under the Manpower Development and Training Act, apprenticeship and other training programs.

Information about advanced training in air-conditioning and refrigeration may be obtained from the Refrigeration Service Engineers Society, 2720 DePlaines Ave., DePlaines, Ill. 60018.

Information about training in oil heating systems may be obtained from the Education Department, National Oil Fuel Institute, 60 East 42nd St., New York, N.Y. 10017.

General information about gas burner mechanics may be obtained from the American Gas Association, Inc., 605 Third Ave., New York, N.Y. 10016.

APPLIANCE SERVICEMEN

(D.O.T. 637.281, 723.381, and 827.281)

Nature of the Work

Appliance servicemen repair all kinds of household appliances—toasters, irons, refrigerators, and ranges, to name but a few. They often specialize in servicing either electric or gas appliances, and may specialize in particular items such as clothes washers and dryers or refrigerators and freezers. They also may install appliances, but installations often are done by other workers.

To determine why an appliance is not operating properly, servicemen may ask the customer how it performed when last used. They may operate the appliance to detect unusual noises, overheating, or excess vibration. Servicemen also look for common sources of trouble such as faulty electrical connections. To check electric and gas systems, they use special tools and testing devices, including ammeters, voltmeters, and pressure gauges. A knowledge of electronics is necessary for many repair jobs.

After locating the trouble, they make the necessary repairs or replacements. To remove old parts and install new ones, servicemen use common handtools, including screwdrivers and pliers, and special tools designed for particular appliances.

Most refrigerators and other large appliances are repaired in customers' homes. If major repairs are necessary, however, the appliance may have to be taken to a repair shop. Servicemen answer customers' questions and complaints about appliances and frequently advise customers about their care and use. For example, they may demonstrate to housewives the proper loading of automatic washing machines or how to arrange dishes in dishwashers.

Appliance servicemen may give estimates to customers on the cost of repairs and keep records of parts used and hours worked on each job.

Places of Employment

About 130,000 people worked as appliance servicemen and installers in 1972, mostly in appliance stores and repair shops. Others worked for service centers operated by appliance manufacturers, wholesalers, and gas and electric utility companies.

Appliance serviceman repairs motor of automatic washer.

Appliance servicemen are employed in almost every community, but are concentrated in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Most appliance servicemen start as helpers and acquire their skills through on-the-job training. In some companies they spend a few months helping to install appliances in homes. In other companies they begin learning basic skills by working in the shop where they rebuild used parts such as washing machine transmissions. Trainees gradually learn how motors, gears, and other parts work. They progress from simple repair jobs, such as replacing a switch, to more difficult jobs such as adjusting washer controls. Trainees as well as experienced servicemen receive supplemental classroom instruction given periodically by appliance manufacturers and local distributors.

Appliance servicemen need up to 3 years' on-the-job experience to become fully qualified. Formal training in appliance repair and related subjects is available from some technical schools and community colleges. A trainee with this type of background can become a qualified serviceman more quickly.

Experienced servicemen continue to attend training classes periodically, and study service manuals to become familiar with new appliances and the proper ways to repair them.

Programs to train unemployed and underemployed workers for entry jobs in the appliance service field were operating in many cities in 1972, under the Manpower Development and Training Act and the JOBS (Job Opportunities in the Business Sector) Program. These programs last from several weeks to a year. With additional training and experience, graduates of these programs can become skilled servicemen.

Employers prefer applicants who have good mechanical aptitude and are high school or trade school graduates who have had courses in electricity, mathematics, and science. Some employers cooperate with local high schools and trade schools to provide students with an opportunity to gain practical experience by working part time in appliance repair shops while attending school.

Appliance servicemen who work in large repair shops or service centers may be promoted to foreman, assistant service manager, or service manager. Preference is given to those who show ability to get along with co-workers and customers. Experienced servicemen who have sufficient funds may open their own appliance stores or repair shops. Some servicemen become instructors who teach others to repair new models of appliances, or technical writers, who prepare service manuals. A few may advance to managerial positions such as regional service or parts manager.

Employment Outlook

Employment of appliance servicemen is expected to grow rapidly through the mid-1980's. In addition to the jobs created by growth of this occupation, thousands of openings will arise each year to replace experienced servicemen who retire, die or transfer to other occupations.

The demand for appliances is expected to increase very rapidly as a result of increases in population and income. Demand also will be stimulated by the introduction of new appliances and by improvements that make existing appliances more attractive or more convenient.

Earnings and Working Conditions

Hourly earnings of appliance servicemen ranged from $3.25 to $6.50 in 1972, based on the limited data available. Starting rates for inexperienced trainees ranged from $2.25 to $3 an hour. The wide variations in wages reflect differences in skill level, type of employer, geographical location, and type of equipment serviced.

Many appliance servicemen work more than 8 hours a day and receive higher rates of pay for overtime. Most appliance servicemen receive paid vacations, sick leave, health insurance, and other fringe benefits.

Appliance repair shops are generally quiet, well lighted, and adequately ventilated. Working conditions outside the shop vary considerably. For example, servicemen sometimes work in narrow spaces and uncomfortable positions amidst dirt and dust. Servicemen who repair appliances in homes may spend several hours a day driving.

Appliance repair work generally is safe, although accidents are possible while the serviceman is handling electrical parts or lifting and moving large appliances. Inexperienced workers are shown how to use tools safely and how to avoid electric shock.

Appliance servicemen usually work with little or no direct supervision. This feature of the job appeals to many people.

Sources of Additional Information

For further information about jobs in the appliance service field contact local appliance repair shops, appliance dealers and utility companies, or the local office of the State employment service. Local offices of State employment services may provide information about the Manpower Development and

Training Act and other programs that provide training opportunities. Local vocational schools that offer courses in appliance servicing, electricity, and electronics can also provide helpful information about training.

Information about training programs or work opportunities also is available from:

Association of Home Appliance Manufacturers, 20 North Wacker Drive, Chicago, Ill. 60606.

National Appliance and Radio-TV Dealers Association, 318 W. Randolph St., Chicago, Ill. 60606.

Gas Appliance Manufacturers Association, 1901 North Fort Myer Drive, Arlington, Va. 22209.

AUTOMOBILE BODY REPAIRMEN

(D.O.T. 807.381)

Nature of the Work

Automobile body repairmen are skilled craftsmen who repair damaged motor vehicles by straightening bent frames, removing dents, welding torn metal, and replacing ruined parts. Body repairmen usually can repair all types of vehicles, but most work mainly on automobiles and small trucks. Some specialize in large trucks, buses, or truck trailers.

Before making repairs, body repairmen generally receive instructions from their supervisors, who determine which parts are to be restored or replaced, and estimate how much time the repairs should take.

Automobile body repairmen use special machines to align damaged frames and body sections. They chain or clamp the machine to the damaged metal and apply hydraulic pressure to straighten it. They also may use special devices to align vehicles that have unit-bodies instead of frames. Some repairmen specialize in straightening frames and unit-bodies. Body repairmen remove badly damaged sections of body panels with a pneumatic metalcutting gun or acetylene torch, and weld in new sections. They push large dents out with a hydraulic jack or hand prying bar, or knock them out with a hand tool or pneumatic hammer. They smooth small dents and creases by holding a small anvil against one side of the damaged area while hammering the opposite side. Very small pits and dimples are removed with pick hammers and punches.

Body repairmen use plastic or solder to fill small dents that cannot be worked out of the metal. The hardened filler is filed or ground to a smooth finish.

After being restored to its original shape, the repaired surface is sanded for painting. In most shops, automobile painters do the painting. (These workers are discussed elsewhere in the *Handbook*.) Some smaller shops employ workers who are combination body repairmen and painters.

Body repair work has variety—each damaged vehicle presents a different problem. Therefore, in addition to having a broad knowledge of automobile construction and repair techniques, repairmen must develop appropriate methods for each job. Most of these skilled craftsmen find their work challenging and take pride in being able to restore automobiles.

Body repairmen usually work by themselves with only general directions from foremen. In some shops, they may be assisted by helpers.

Places of Employment

About 160,000 persons worked as automobile body repairmen in 1972. Most worked for shops that specialized in body repairs and painting, and for automobile and truck dealers. Other employers included organizations that maintain their own motor vehicles, such as trucking companies and buslines. Motor vehicle manufacturers employed a small number of these workers.

Automobile body repairmen can find work in every section of the country. Geographically, jobs are distributed about the same as population.

Training, Other Qualifications, and Advancement

Most automobile body repairmen learn the trade on the job. Young persons usually start as helpers and pick up skills from experienced workers. Helpers begin by assisting body repairmen in tasks such as removing damaged parts and installing repaired surfaces in preparation for painting. They gradually learn to remove small dents and make other minor repairs, and progress to more difficult tasks. Generally, 3 to 4 years of on-the-job training are needed to become a fully qualified body repairman. Most training authorities recommend a 3- or 4-year formal apprenticeship program as the best way to learn the trade, but relatively few of these programs are available. Apprenticeship includes both on-the-job and classroom instruction.

In 1972, body repair training programs to prepare unemployed and underemployed workers for entry jobs were in operation in many cities under the Manpower Development and Training Act. These programs, which last up to a year, stress the fundamentals of automobile body repair. Graduates need additional on-the-job or apprenticeship training to qualify as skilled body repairmen.

Young persons who want to learn this trade should be in good physical condition and have good eye-hand coordination. Courses in automobile body repair, offered by high schools, vocational schools, and private trade schools, provide helpful experience, as do courses in automobile mechanics. Although completion of high school generally is not a requirement, many employers believe graduation indicates that a young person can "finish a job."

Automobile body repairmen must buy handtools, but employers usually furnish power tools. Trainees are expected to accumulate tools as they gain experience. Many repairmen have a few hundred dollars invested in tools.

An experienced automobile body repairman with supervisory ability may advance to shop foreman. Many open their own shops.

Employment Outlook

Employment of automobile body repairmen is expected to increase moderately through the mid-1980's. In addition, more than a thousand openings are expected each year from the need to replace experienced repairmen who retire or die. Job openings also will occur as some transfer to other occupations.

Employment is expected to increase as a result of the rising number of motor vehicles damaged in traffic. Accident losses are expected to increase as the number of motor vehicles grows, even though better highways, driver training courses, and improved bumpers and safety features on new vehicles may slow the rate of increase.

Earnings and Working Conditions

Body repairmen employed by automobile dealers in 34 large cities had estimated average hourly earnings of $6.52 in 1972, about three-fourths more than the average for all nonsupervisory workers in private industry, except farming. Skilled body repairmen usually earn between two and three times as much as inexperienced helpers and trainees.

Many body repairmen employed by automobile dealers and repair shops are paid a commission, usually about half of the labor cost charged to the customer. Under this method, earnings depend on the amount of work assigned to the repairman and how fast he completes it. Employers frequently guarantee their commissioned repairmen a minimum weekly salary. Helpers and trainees usually receive an hourly rate until they are skilled enough to work on commission. Body repairmen employed by trucking companies, buslines, and other organizations that maintain their own vehicles usually are paid by the hour. Most body repairmen work 40 to 48 hours a week.

Many employers of body repairmen provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans. Some shops furnish laundered uniforms.

Automobile body shops are noisy because of the banging of hammers against metal and the whir of power tools. Most shops are well ventilated, but often are dusty and have the odor of paint. Body repairmen often work in awkward or cramped positions, and most of their work is strenuous and dirty. Hazards include cuts from sharp metal edges, burns from torches and heated metal, and in-

juries from power tools.

Many automobile body repairmen are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most body repairmen who are union members work for large automobile dealers, trucking companies, and buslines.

Sources of Additional Information

More details about work opportunities may be obtained from local employers, such as automobile body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile body repairmen may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils of America, Inc., 4001 Warren Blvd., Hillside, Ill. 60162.

AUTOMOBILE MECHANICS

(D.O.T. 620.131 through .381, .782, and .885; 721.281 and 825.281)

Nature of the Work

Automobile mechanics keep the Nation's automobiles in good operating condition. They perform preventive maintenance, diagnose breakdowns, and make repairs. (Although truck mechanics, bus mechanics, and automobile body repairmen are sometimes called "automobile mechanics," they are discussed separately in the *Handbook*.)

Preventive maintenance is the periodic examination, and adjustment, repair, or replacement of parts. This important responsibility of the mechanic is vital to safe and trouble-free driving. In preventive maintenance, mechanics may follow a checklist to be sure they examine all important parts. They may, for example, examine and decide whether to replace worn parts, such as distributor points; clean, adjust, or replace spark plugs; adjust the carburetor; and balance the wheels.

When mechanical or electrical troubles occur, mechanics first get a description of the symptoms from the owner. If the cause of the trouble is hard to find, they may use testing equipment, such as motor analyzers, spark plug testers, compression gauges. The ability to make a quick and accurate diagnosis is one of the mechanic's most valuable skills and requires analytical ability as well as a thorough knowledge of a car's operations. Many mechanics consider diagnosing "hard to find" troubles one of their most challenging and satisfying duties.

After locating the problem, mechanics make needed adjustments and repairs, such as grinding valves or cleaning the carburetor. If a mechanic cannot fix a part, he replaces it.

In addition to testing equipment, automobile mechanics use many other kinds of tools ranging from simple handtools (screwdrivers, wrenches, pliers), to complicated equipment, such as wheel alinement machines and headlight aimers. Mechanics also consult repair manuals and parts catalogs, since various makes of automobiles require different parts and adjustments.

Most automobile mechanics perform a variety of repairs; others specialize. The types of work done by some mechanic specialists are described briefly:

Automatic transmission specialists work on gear trains, couplings, hydraulic pumps, and other parts of automatic transmissions. These are complex mechanisms; their repair requires considerable experience and training, including a knowledge of hydraulics. *Tune-up men* adjust the ignition timing and valves, and adjust or replace spark plugs, distributor points, and other parts to insure efficient engine performance. They often use scientific test equipment to locate malfunctions in fuel and ignition systems. *Automobile air-conditioning specialists* install air-conditioners and service components such as compressors and condensers. *Front-end mechanics* align and balance wheels and repair steering mechanisms and suspension systems. They frequently use special alignment equipment and wheel-balancing machines. *Brake mechanics* adjust brakes, replace brake linings, repair hydraulic cylinders, and make other repairs on brake systems. Those employed in repair shops that specialize in brake service also may replace shock ab-

sorbers, springs, and mufflers. In some shops, combination front-end and brake mechanics are employed. *Automobile-radiator mechanics* clean radiators with caustic solutions, locate and solder leaks, and install new radiator cores. They also may repair heaters and air-conditioners, and solder leaks in gasoline tanks. *Automobile-glass mechanics* replace broken windshield and window glass and repair window operating mechanisms. They install pre-formed glass to replace curved windows, and they use window patterns and glass cutting tools to cut replacement glass from flat sheets.

Places of Employment

About 700,000 persons worked as automobile mechanics in 1972. Most worked for automobile dealers, automobile repair shops, and gasoline service stations. Many others were employed by Federal, State, and local governments, taxicab and automobile leasing companies, and other organizations that repair their own automobiles. Some mechanics also were employed by automobile manufacturers to make final adjustments and repairs at the end of the assembly line. A small number of mechanics worked for department stores that have automobile service facilities.

Most automobile mechanics work in shops that employ from one to five mechanics, but some of the largest shops employ more than a hundred. Generally, automobile dealer shops are larger than independent repair shops.

Automobile mechanics work in every section of the country. Geographically, employment is distributed about the same as population.

Training, Other Qualifications, and Advancement

Most automobile mechanics learn the trade on the job. Young persons usually start as helpers, lubrication men, or gasoline service station attendants, and gradually acquire skills by working with experienced mechanics. Although a beginner can make simple repairs after a few months' experience, 3 to 4 years are required to become an all-round mechanic, and an additional year or two to learn a difficult specialty, such as automatic transmission repair. In contrast, radiator mechanics, glass mechanics, and brake specialists, who do not need an all-round knowledge of automobile repair, may learn their jobs in about 2 years.

Most training authorities recommend a 3- or 4-year formal apprenticeship program as the best way to become an all-round mechanic. These programs include both on-the-job training and classroom instruction in nearly all phases of automobile repair.

For entry jobs, employers look for young persons with mechanical aptitude and a knowledge of automobiles. Generally, a driver's license is required. Practical experience in automobile repair gained from working as a gasoline service station attendant, training in the Armed Forces, or working on cars as a hobby is valuable. Completion of high school is an advantage in obtaining an entry job, because to most employers it indicates that a young person can finish a job and has potential for advancement. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools are helpful. Courses in science and mathematics help a person better understand how an automobile operates.

Training programs for unemployed and underemployed workers seeking entry jobs as automobile mechanics are in operation in a large number of cities under the Manpower Development and Training Act. These programs, which last up to a year, stress basic maintenance and repair work. Persons who complete this training are able to make simple repairs, but they need additional on-the-job or apprenticeship training to qualify as skilled mechanics.

Most mechanics must buy their handtools. Beginners are expected to accumulate tools as they gain experience. Many experienced mechanics have several hundred dollars invested in tools. Employers furnish power tools, engine analyzers, and other test equipment.

Employers sometimes send experienced mechanics to factory training centers to learn to repair

new car models or receive special training in subjects such as automatic transmission or air-conditioning repair. Manufacturers also send representatives to local shops to conduct short training sessions. A relatively small number of young high school graduates are selected by automobile dealers to attend factory-sponsored mechanic training programs.

Experienced mechanics in a large shop may advance to supervisory positions, such as repair shop foreman or service manager. Mechanics who like to work with customers may transfer to service advisors jobs. Many mechanics open their own repair shops or gasoline service stations.

Employment Outlook

Employment of automobile mechanics is expected to increase moderately through the mid-1980's. In addition to the job openings from employment growth, several thousand openings are expected each year from the need to replace experienced mechanics who retire or die. Job openings also will occur as some mechanics transfer to other occupations.

Employment is expected to increase because expansion of the driving age population, consumer purchasing power, and multicar ownership will increase the number of automobiles. Employment also is expected to grow because a greater number of automobiles will be equipped with pollution control devices, air-conditioning, and other features that increase maintenance requirements.

Primarily because of greater efficiency in the shop, employment of mechanics is not expected to grow as rapidly as the number of automobiles. For example, increased mechanic specialization and the growing use of test equipment (such as dynamometers and engine analyzers) should reduce the time needed to diagnose malfunctions and check the quality of repairs.

Earnings and Working Conditions

Skilled automobile mechanics employed by automobile dealers in 34 cities had estimated average hourly earnings of $6.15 in 1972, about two-thirds more than the average for all nonsupervisory workers in private industry, except farming. Skilled mechanics usually earn between two and three times as much as inexperienced helpers and trainees.

Many experienced mechanics employed by automobile dealers and independent repair shops are paid a commission, usually about half the labor cost charged to the customer. Under this method, weekly earnings depend on the amount of work assigned and completed by the mechanic. Employers frequently guarantee commissioned mechanics a minimum weekly salary. Helpers and trainees usually are paid an hourly rate until they are sufficiently skilled to work on commission. Some mechanics receive an hourly rate.

Most mechanics work between 40 and 48 hours a week but many work even longer during busy periods. Mechanics paid by the hour frequently receive overtime rates for hours over 40 a week.

Many employers provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans. Laundered uniforms are furnished free of charge by some employers.

Generally, a mechanic works indoors. Modern automobile repair shops are well ventilated, lighted, and heated, but older shops may not have these advantages.

Mechanics frequently work with dirty and greasy parts, and in awkward positions. Sometimes they must lift heavy objects. Minor cuts and bruises are common, but serious accidents usually are avoided by observing safety practices.

Some mechanics are members of labor unions. Among the unions organizing these workers are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffers, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

For more details about work opportunities, contact local employers such as automobile dealers and repair shops; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may have information bout the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile mechanics may be obtained from:

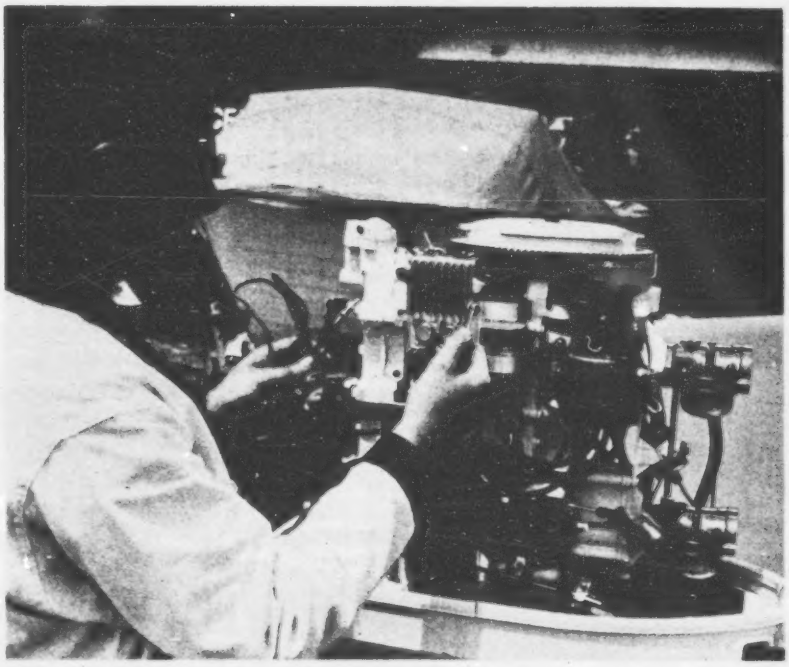
Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils of America, Inc., 4001 Warren Blvd., Hillside, Ill. 60162.

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

BOAT MOTOR MECHANICS

(D.O.T. 623.281 and 625.281)



Nature of the Work

Boat motors have many things in common with automobile motors, including unannounced breakdowns. A reliable motor is particularly essential in boating. Breakdowns far from shore can leave a boatman stranded for hours—a frustrating and potentially dangerous predicament if the weather turns bad.

To minimize the possibility of breakdowns, motor manufacturers recommend periodic inspections by qualified mechanics to have motors examined and repaired and worn or defective parts replaced. For example, they may replace ignition points, adjust valves, and clean the carburetor. After completing these tasks, they run the motor to check for other needed adjustments. Routine maintenance jobs normally make up most of the mechanic's work load.

When breakdowns occur, mechanics diagnose the cause and make the necessary repairs. A quick and accurate diagnosis—one of the mechanic's most valuable skills—requires analytical ability as well as thorough knowledge of the motor's operation. Some jobs require only the replacement of a single item, such as fuel pump, and may be completed in less than an hour. In contrast, tearing down and reassembling a motor to replace worn valves, bearings, or piston rings may take a day or more.

Mechanics may specialize in either outboard or inboard motors, although many repair both. Most small boats have portable gasoline-fueled outboard motors. Inboards are located inside the boat (much like the engine in a car) and are primarily in larger craft, such as cabin cruisers and commercial fishing boats. Large inboard engines and automobile and truck engines are similar in design and operation. Some inboards burn diesel fuel rather than gasoline.

In large shops, mechanics usually work only on motors and other running gear. In small shops, however, they may patch and paint hulls, and repair steering mechanisms, lights, and other boat equipment. In addition, they may repair motorcycles, mini-bikes, snowmobiles, lawn mowers, and other machines which have small gasoline engines.

Mechanics use common handtools such as screwdrivers and wrenches; power and machine tools including drills and grinders; and hoists to lift motors and boats. Motor analyzers, compression gauges, and other testing devices help mechanics locate faulty parts. Mechanics refer to service manuals for assistance in assembling and repairing motors.

Places of Employment

Most of the estimated 10,000 full-time boat-motor mechanics employed in 1972 worked in the shops of boat dealers and marinas. Others made final adjustments and repairs at the end of the assembly line for motor manufacturers. A small number of mechanics worked for boat rental firms. Marinas operated by Federal, State, and local governments also employed mechanics.

Dealer and marina shops typically employ one to three mechanics; few employ more than 10. Small dealers and marinas send repair work to larger shops.

Boat-motor mechanics work in every State, but employment is concentrated along coastal areas in New York, California, Texas, Florida, Washington, Massachusetts, and Louisiana, and near the numerous lakes and rivers in Michigan, Illinois, Ohio, Minnesota, Pennsylvania, Missouri, and Indiana. Mechanics who specialize in out-

board motors work in all areas. Those who specialize in inboard motors work mostly near oceans, bays, and large lakes.

Training, Other Qualifications, and Advancement

Boat-motor mechanics learn their skills primarily through on-the-job training. At first, trainees clean boats and motors and do other odd jobs. Under the guidance of mechanics they learn to remove and disassemble motors, replace ignition points and spark plugs, and do other routine tasks. As trainees gain experience, they progress to more difficult tasks such as diagnosing the cause of breakdowns and overhauling motors. Generally, an inexperienced beginner needs 2 to 3 years on the job to become skilled in repairing both outboard and inboard gasoline motors. A capable mechanic can learn to repair diesels in an additional year or two.

Employers sometimes send trainees and mechanics to factory-sponsored courses for 1 to 2 weeks. Trainees learn the fundamentals of motor repair. Mechanics upgrade their skills and learn to repair new models.

When hiring trainees, employers look for young persons who have mechanical aptitude, are in good physical condition, and have an interest in boating. High school graduates are preferred, but many employers will hire applicants with less education. High school courses in small engine repair, automobile mechanics, and machine shop are helpful, as are science and mathematics. Before graduating, a person may be able to get a summer job as a mechanic trainee.

In 1972, under provisions of the Manpower Development and Training Act (MDTA), the unemployed and underemployed were trained in a small number of cities for outboard motor repair, and in many cities for small engine and automobile repair which can be applied to boat-motor repair.

Mechanics usually are required to furnish their own handtools which cost several hundred dollars. Employers provide power tools and test equipment.

Mechanics who have leadership ability can advance to supervisory positions such as shop foremen or service managers. Mechanics who have the necessary capital may establish their own dealerships or marinas.

Employment Outlook

Employment in this relatively small occupation is expected to increase rapidly through the mid-1980's. In addition to the jobs resulting from employment growth, some openings will arise as experienced mechanics retire, die, or transfer to other occupations.

Increases in population, personal income levels, and leisure time will create a demand for more motorboats and mechanics. A growing number of new boats will be equipped with automatic tilts, power-trim controls, and other convenience features—all of which increase maintenance requirements. Moreover, growth in the number of mini-bikes and snowmobiles will add to the demand for mechanics.

Earnings

In 1972, hourly earnings of experienced mechanics ranged from about $3 to $6.50 based on information obtained from a limited number of boat dealers and marinas. Experienced mechanics generally earned two to three times as much as trainees.

Most mechanics are paid an hourly rate or weekly salary. Others are paid a percentage—usually 50 percent of the labor charges for each repair job. If a mechanic is paid on a percentage basis, his weekly earnings depend on the amount of work he is assigned and the length of time he takes to complete it.

Boating activity increases sharply as the weather grows warmer. Consequently, many mechanics work more than 40 hours a week in spring and summer. During winter, however, they may work less than 40 hours a week; a relatively small number are laid off. In Northern States, some of the winter slack is taken up by repair work on snowmobiles.

Many employers provide holiday and vacation pay and additional benefits such as life, health, and accident insurance. Some also provide paid sick leave, contribute to retirement plans, and furnish laundered uniforms free of charge. A few have profit-sharing programs for their mechanics.

Boat-motor repair work is not hazardous, but mechanics sometimes suffer cuts, bruises, and other minor injuries. Shop working conditions vary from clean and spacious to dingy and cramped. All shops are noisy when engines are being tested. Mechanics occasionally must work in awkward positions to adjust or replace parts. For many mechanics, however, these disadvantages are more than compensated for by the variety of work assignments and the satisfaction which comes from solving problems. Moreover, mechanics may enjoy working near water recreation areas.

Sources of Additional Information

Details about training or work

opportunities in this field may be obtained from local boat dealers and marinas or local State employment offices.

BOWLING-PIN-MACHINE MECHANICS

(D.O.T. 639.381 and 829.281)

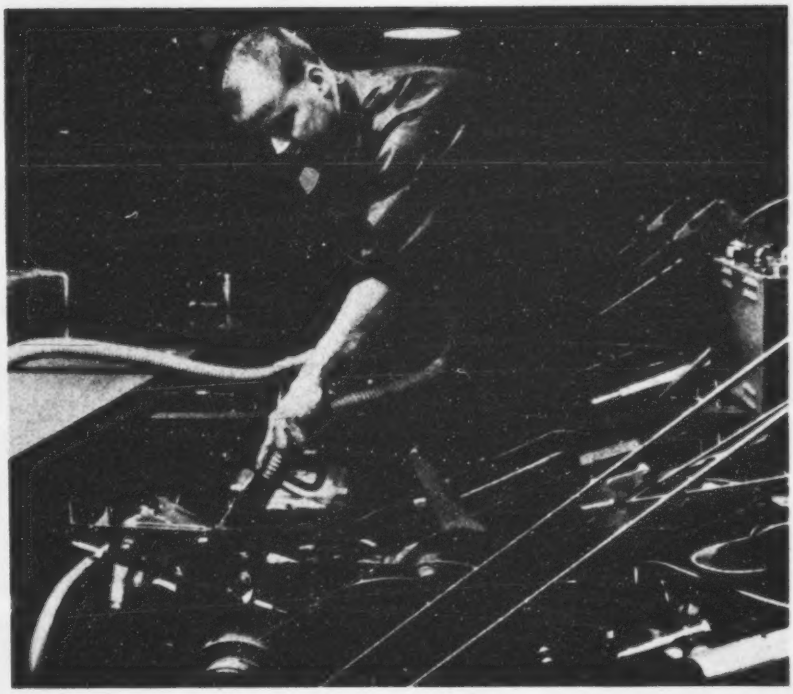
Nature of the Work

Bowling-pin-machine (or automatic pinsetting machine) mechanics repair and maintain the tens of thousands of pinsetting machines in use today. These complex machines automatically return the ball to the bowler, clear fallen pins, and reset pins.

Mechanics must have a thorough knowledge of the mechanism of pinsetting machines to keep them running properly. This knowledge is especially important when machines malfunction, because mechanics must quickly find the cause of the trouble and make repairs or adjustments so that bowlers will not be inconvenienced and annoyed.

Mechanics spend much of their time doing work to prevent breakdowns and delays. They regularly inspect pinsetting machines and clean, lubricate, and adjust them. When delays do occur, mechanics repair or replace parts, such as broken chains, worn shock absorbers, and faulty electrical parts. Mechanics refer to troubleshooting manuals and diagrams of electrical circuits to guide their work.

Mechanics use many different types of tools, such as wrenches, screwdrivers, hammers, portable hoists, and lubricating guns. They use ohmmeters, voltmeters, and other devices to test electrical circuits, relays, transformers, and motors. Often mechanics will buy their own sets of handtools but employers usually supply special tools.



Mechanic vacuum cleans bowling pin machine.

Mechanics may supervise one or more assistant mechanics or trainees. They teach trainees to locate and correct minor problems in pinsetting machines by demonstrating how the machines operate and by disassembling components and explaining their functions. Mechanics show trainees how to break minor pin-jams and recondition pins.

Mechanics do some clerical work. They order replacement parts and keep inventory of parts in stock. They also may keep records of machine malfunctions and estimate maintenance costs.

Places of Employment

About 6,000 bowling-pin-machine mechanics were employed in 1972. Most worked in bowling centers. The remainder, about 5 percent, were employed by manufacturers of pinsetting machines to install and service the machines.

Bowling-pin-machine mechanics are employed in every State, but employment is concentrated in heavily populated areas, where there are many bowling centers.

Training, Other Qualifications, and Advancement

Pinsetting machine mechanics usually start out as trainees. Employers prefer to hire applicants who are high school graduates, although many have not completed high school. Courses in electricity, blueprint reading, and machine repair are useful.

Some mechanic trainees are sent to schools operated by bowling machine manufacturers. To attend a factory school, candidates must take written tests to determine

their mechanical aptitude. Usually, they must be at least 16 years old. Trainees' wages and expenses are paid by employers during the training period, which usually lasts 4 weeks. Trainees study the structure and operation of machines made by the firm operating the school, and learn to locate typical sources of trouble. They learn how to perform preventive maintenance, to read wiring diagrams and to use the tools of the trade. After attending factory schools, trainees usually need several months of on-the-job experience to qualify as mechanics.

Trainees who do not attend factory schools learn their skills on the job by watching experienced mechanics at work and by receiving instruction in machine operation and maintenance. Usually, 1 to 2 years of on-the-job training and experience are needed to acquire mechanics' skills.

Young people planning careers as bowling-pin-machine mechanics should have good eyesight (including normal color vision), eye-hand coordination, and average physical strength. They also should have mechanical ability and like to work with their hands. Because speed is usually required in repairing pinsetting machines, ability to work under pressure also is important.

A qualified mechanic trainee employed in a bowling center may be promoted to assistant mechanic and then to head mechanic. Some mechanics become managers or owners of bowling establishments. Those who work for manufacturers may advance to the position of service manager or instructor in a training school.

Employment Outlook

Employment of bowling-pin-machine mechanics is expected to grow slowly through the mid-1980's. Most job openings will arise because of the need to replace experienced mechanics who retire, die, or transfer to other occupations.

The demand for bowling facilities is likely to grow as population increases, incomes rise, and more time for recreation becomes available. Employment of mechanics, however, will be limited by improvements in pinsetting machines. Older machines are being replaced by improved models that need less maintenance; thus, mechanics are able to service a greater number of machines.

Earnings and Working Conditions

According to information from a limited number of union contracts, mechanics earned from $3.01 to $4.16 an hour in 1972, and head mechanics from $3.80 to $4.79. Earnings of trainees ranged from $2.80 to $3.55 an hour.

On the East Coast and in the Midwest most mechanics and trainees work a 48-hour, 5-day week. Nightwork and work on Sundays and holidays is common. Workers covered by union contracts receive premium pay for overtime and get 9 to 11 paid holidays a years. They typically receive 2 weeks' paid vacation after a year's service, 3 weeks after 3 years' service, and 4 weeks after 5 years' service. Many contracts provide for health insurance and pension plans financed entirely by employers.

Mechanics work in a long, relatively narrow corridor at one end of a bowling establishment where the automatic machines are located. The work area includes space for a workbench and is usually well lighted and well ventilated, but quite noisy when the lanes are operating. When making repairs and adjustments, mechanics frequently have to climb and balance their bodies on the framework of the pinsetting machines, and to stoop, kneel, crouch, and crawl around the machines. Mechanics employed by manufacturers to install and service machines must do considerable traveling.

Mechanics usually do not have to wear any special safety devices, such as goggles. Safety guards are provided on the pin-setting machines, but workers are subject to common shop hazards, such as electrical shock, cuts, falls, and bruises. Repairmen often wear coveralls to protect themselves from grease and dirt.

Mechanics and trainees employed in large metropolitan areas generally are members of unions, usually the Service Employees' International Union or the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.).

Sources of Additional Information

Young people who want further information about training or work opportunities in this trade should contact proprietors of bowling centers in their area, the local bowling proprietors' association, or locals of the unions previously mentioned. The local office of the State employment service is another source of information about employment and training opportunities.

BUSINESS MACHINE SERVICEMEN

(D.O.T. 633.281)

Nature of the Work

Business machine servicemen maintain and repair the machines

that are used to speed the paperwork in business and government. These include typewriters, adding and calculating machines, cash registers, dictating machines, postage meters, and duplicating and copying equipment. (Servicemen who work on computers are discussed in a separate statement elsewhere in the *Handbook*.)

Servicemen often work in offices where the machines are used. They may maintain equipment by regular, frequent visits to inspect, clean, and oil the machines, or to make minor repairs or adjustments. When machines break down, they diagnose and correct the cause of the trouble. Often servicemen locate the problem and make repairs on the spot. For major repairs, however, they usually take machines to the shop. Many servicemen repair a variety of machines; others specialize in one or a few types. For example, specialists usually service duplicators, copiers, postage meters, and mailing equipment.

Servicemen use common handtools, such as screwdrivers and pliers, and test equipment, such as guages and meters. In large shops, they use drill presses, lathes, and other power equipment.

Business machine servicing offers considerable variety in work assignments. People who have analytical ability find considerable satisfaction in finding and correcting the cause of trouble in a faulty machine.

Some servicemen may also do sales work. Most commonly, they sell preventive maintenance contracts for regular machine servicing. Some also sell supplies, such as special paper, ink, ribbons, and stencils.

Places of Employment

About 70,000 people worked as business machine servicemen in 1972. A small number were women. About three-fourths of business machine servicemen worked mainly on typewriters, calculators and adding machines, and copiers and duplicators. Most of the rest serviced accounting-bookkeeping machines, cash registers, and postage and mailing equipment. A small number repaired dictating machines.

Business machine repairman adjusts copying machine.

Most servicemen worked for business machine manufacturers, dealers, and repair shops. The remainder worked for Federal, State and local governments, and large organizations that had enough machines to justify full-time servicemen.

In a manufacturer's branch office, servicemen usually work exclusively on the manufacturer's products. They specialize in one or two machines or service the full line of equipment. In a small city, specialization is impractical so most servicemen repair and sell all kinds of equipment.

Business machine servicemen work throughout the country. Even relatively small communities usually have at least one or two repair shops. Most servicemen, however, work in large cities.

Training, Other Qualifications, and Advancement

Applicants for entry jobs as business machine servicemen usually need at least a high school education. Some companies accept young people who have not completed high school. Employers like to employ veterans who have had electronics training in the Armed Forces. Applicants who are interested in working on electronic equipment must have 1 year or more of training or experience in electronics.

Applicants for entry jobs may have to pass tests that measure mechanical aptitude, knowledge of electricity or electronics, manual dexterity, and general intelligence. Good eyesight, including color vision, is needed.

Employers seek applicants who have a pleasant, cooperative manner. Because most machine servicing is done in customers' offices, the ability to work without interrupting the office routine is very important. A neat appearance and ability to converse effectively also are desirable.

Some employers require that business machine servicemen be bonded. Applicants for these jobs must be honest and trustworthy since they are exposed to large sums of money and other valuables in banks and offices. Servicemen also may collect money from customers for services and supplies.

Beginners generally acquire skills through on-the-job training, work experience, and instruction in manufacturers' schools. Some vocational and private correspondence schools conduct courses in business machine maintenance for trainees and others. In addition, programs to train unemployed and underemployed workers as office machine servicemen were operating in several cities in 1972 under the provisions of the Manpower Development and Training Act.

Business machine servicemen who work in a manufacturer's branch office learn to repair only the company's line of machines. Trainees usually attend company schools from a few weeks to several months, depending on the type of machine they will service. They then receive from 1 to 3 years of practical experience and on-the-job training before they become fully qualified servicemen. Occasionally, they may return to factory schools for special instruction in new business machine developments. Servicemen are encouraged to broaden their technical knowledge during nonworking hours. Many companies pay the serviceman's tuition for work-related courses in college and technical schools.

Business machine servicemen may move into sales positions for greater earnings. Servicemen who show exceptional abilities also may advance to foreman, service manager, or supervisor. Experienced servicemen sometimes open their own repair shops; those who work in manufacturers' branch offices sometimes become independent dealers or purchase sales franchises from the company.

Employment Outlook

Employment of business machine servicemen is expected to grow very rapidly through the mid-1980's. In addition to jobs from employment growth, many openings will arise as experienced servicemen retire, die, or change occupations.

Business and governments will buy more machines to handle the growing volume of paperwork and more servicemen will be needed to maintain and repair these machines. In recent years, many technical changes have occurred in long-established types of business machines. For example, electronic calculating machines have replaced mechanical models. Because of the greater use of such equipment, opportunities will be particularly favorable for servicemen who have training in electronics.

Business machine servicemen work year-round and have steadier employment than many other skilled workers. Office machines must be maintained, even when business slackens, since records must be kept, correspondence carried on, and statistical reports prepared.

Earnings and Working Conditions

Information obtained from a limited number of employers in 1972 indicated that experienced servicemen generally earned from $150 to $250 a week. Wages depend on geographic location, machine serviced, and the length of employment. Wages generally were lowest for workers who repair only typewriters, adding machines, calculators, cash registers, or dictating machines. Rates usually were highest for servicemen of accounting-bookkeeping machines, postage and mailing machines, and complex duplicating and copying equipment.

New trainees earn from $110 to $160 a week. As they become more skilled, their pay increases. People who have previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages.

In addition to salaries, servicemen in some companies receive commissions for selling supplies or service contracts. Many employers pay all or part of life and hospitalization insurance and pension plans.

Servicing business machines is cleaner and lighter than the work in most other mechanical trades. Servicemen generally wear business suits and do most of their work in the offices which own the machines. Injuries are uncommon. Some positions involve considerable traveling within the area served by the employer. Servicemen who use their own cars for company business are reimbursed on a mileage basis. Employers usually pay for all tools.

Sources of Additional Information

For more details about job op-

portunities contact local firms that repair business machines and the local office of the State employment service. The State employment service also may have information about the Manpower Development and Training Act and other training programs.

COMPUTER SERVICE TECHNICIANS

(D.O.T. 828.281)

Nature of the Work

Computer systems play a vital role in today's way of life. They help us make telephone calls, receive paychecks on time, and reserve tickets for travel, hotels, and entertainment. In business and industry, computer systems perform a wide variety of complicated tasks—from keeping business records to controlling manufacturing processes.

A computer system is the combination of a computer and computer-related machines, such as magnetic tape readers and high speed printers. Keeping this intricate set of machines in good working order is the job of a highly qualified computer service technician.

At regular intervals, technicians (sometimes called field engineers or customer engineers) service machines or systems to keep them operating efficiently. They routinely adjust, oil, and clean mechanical and electro-mechanical parts. They also check electronic equipment for loose connections and defective components or circuits.

Despite this regular care, however, computer equipment sometimes breaks down. Technicians must then find the cause of the failure and make necessary repairs. For example, they may replace a faulty circuit board, resolder a broken connection, or repair a mechanical part. They must complete the job as quickly as possible, because working time lost during a computer breakdown may cost a customer several hundred or even thousands of dollars an hour.

Computer technicians often help install new equipment. They lay cables, hook up electrical connections between machines, thoroughly test the new equipment, and correct any problems before the customer uses the machine.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. For example, some technicians are experts in correcting problems caused by errors in the computer's internal programming. Specialists usually have advanced training and several years of experience.

To diagnose electronic failures, technicians must use several kinds of test equipment, including voltmeters, ohmmeters, and oscilloscopes. They also run special computer programs that help pinpoint some kinds of malfunctions. Technicians also use a variety of handtools such as needle-nosed pliers, wirestrippers, and soldering equipment. The employer supplies tools and test equipment, but technicians may be responsible for keeping the equipment in working order.

Besides knowing how to use specialized tools and test equipment, computer technicians must be familiar with technical and repair manuals for each piece of equipment. They must keep up too with the technical information and revised maintenance procedures issued periodically by computer manufacturers.

Technicians keep a record of preventive maintenance and repairs on each machine they service. In addition, they fill out time and expense reports, keep parts inventories, and order parts.

Although technicians spend most of their time working on machines, they work with people also. They listen to the customer's complaints, answer questions, and sometime offer technical advice on ways to keep equipment in good condition. Experienced technicians help train new technicians, and sometimes have supervisory duties.

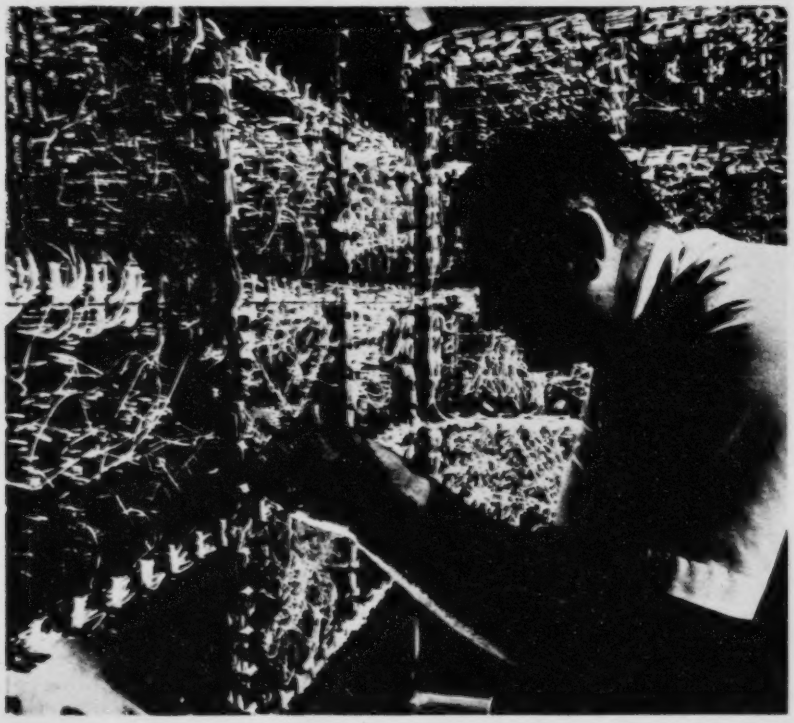
Places of Employment

In 1972, nearly all of the 45,000 computer service technicians employed worked in service departments of computer manufacturing firms. A small number worked for companies that sell computer maintenance services and for the Federal Government and other organizations that have large computer installations. A few women work in this occupation.

Computer technicians work in all parts of the country, usually in urban areas where most computer equipment is located. Some technicians work full-time at a single installation, such as a large computer center operated by a bank or insurance company. Others travel from place to place to maintain several different systems or to make emergency repairs. A technician with special training or experience may travel hundreds of miles from the home office to handle difficult repair jobs. Technicians who work for a nationwide organization must sometimes transfer to another city or State.

Training, Other Qualifications, and Advancement

Most employers require applicants for technician trainee jobs to have 1 to 2 years' post-high school



Service technician repairs computer wiring.

training in basic electronics or electrical engineering. This training may be from a computer school, a technical institute, a college, or a junior college. Basic electronics training offered by the Armed Forces is excellent preparation for technician trainees.

A high school student interested in becoming a computer service technician should take courses in mathematics and physics. High school courses in electronics and computer programming also are helpful. Young people can also gain valuable experience through hobbies which involve electronics, such as operating ham radios or building stereo equipment.

Training programs in electronic mechanics for unemployed workers were operated in several cities in 1972 under the Manpower Development and Training Act. Graduates of these programs may qualify for computer service trainee jobs.

Besides technical training, applicants for trainee jobs must have good close vision and normal color perception to work with small parts and color-coded wiring. Normal hearing is needed since some breakdowns are diagnosed by sound. Because technicians usually handle jobs alone, they must have the initiative to work without close supervision. Also important are a pleasant personality and neat appearance, since the work involves frequent contact with customers. Applicants must pass a physical examination and, in some cases, get a security clearance.

Trainees usually attend company training centers for 3 to 6 months to learn elementary computer theory, computer math, and circuitry theory and to further their study of electronics. Classroom work is accompanied by practical training in operating computer equipment, doing basic maintenance, and using test equipment.

In addition to formal instruction, trainees must complete 1 to 2 years of on-the-job training. At first they work closely with experienced technicians, learning to maintain card readers, printers, and other machines that are relatively simple, but that have the basic mechanical and electronic features of a large computer system. As they gain experience trainees work on more complex equipment and make emergency repairs.

Because manufacturers continually redesign equipment and develop new uses for computers, experienced technicians frequently must attend training sessions to keep up with these changes and to broaden their technical skills. Many technicians take advanced training to specialize in a particular computer system or type of repair. Instruction also may include programming, systems analysis, and other subjects that improve the technician's general knowledge of the computer field.

Experienced technicians with advanced training may become technical specialists who help technicians make difficult repairs and work with engineers in designing equipment and developing maintenance procedures. Those with leadership ability may become supervisors or service managers.

Although advancement depends mainly on ability and experience, chances are improved if the technician has a bachelor's degree in electrical engineering. Many technicians get their degrees at company expense. Engineers interested in professional careers in computer service work often start out as technicians.

Most computer equipment oper-

ates on the same basic principles, but machines built by different companies may be unique in design and construction. For this reason, technicians may find it difficult to transfer from one company to another. Technicians who transfer may lose seniority and need some retraining.

Training and experience in computer maintenance may also qualify a technician for jobs in programming, systems analysis, management, and equipment sales. (See statements on programmers, systems analysts, and office machine and computer manufacturing elsewhere in the *Handbook*.)

Employment Outlook

Employment of computer technicians is expected to grow very rapidly through the mid-1980's. As the Nation's economy expands, more computer equipment will be used and more technicians needed to install and maintain it. Business, government, and other organizations will buy or lease additional equipment to manage vast amounts of information, control manufacturing processes, and aid in scientific research. The development of new uses for computers also will spur demand.

Although most job openings will result from employment growth, many also will occur as experienced technicians advance to more responsible jobs or move into other occupations. Because most technicians are young, relatively few openings will stem from deaths and retirements.

Earnings and Working Conditions

Starting salaries for computer service technician trainees ranged from about $140 to $150 a week in 1972, based on the limited information available. Salaries for experienced technicians ranged from about $210 to $315 a week.

The normal workweek is 40 hours, but technicians often work overtime and on weekends to make emergency repairs. Many technicians work rotating shifts—days one week, nights the next.

Employers provide group life and health insurance, retirement plans, sick leave, and other benefits. Vacations range from 1 to 4 weeks a year. Employers also pay for travel and work-related education expenses.

Although some bending and lifting is necessary, the computer technician's job is not strenuous. Work hazards are limited mainly to burns and electrical shock, and can be avoided if safety practices are followed.

Sources of Additional Information

General information on careers in computer maintenance is available from:

American Federation of Information Processing Societies, Inc., 210 Summit Ave., Montvale, N.J. 07645.

Institute of Electrical and Electronic Engineers, 345 East 47th St., New York, N.Y. 10017.

The personnel and service departments of computer manufacturers and other firms employing computer technicians can provide details on training and job opportunities.

The State department of education at each State's capital can furnish information about approved technical institutes, junior colleges, and other institutions offering post-high school training in basic electronics. Information about these schools also is available from:

American Association of Junior Colleges, Suite 410, 1 Dupont Circle, Washington, D.C. 20036.

Details on training programs in electronic mechanics operated under the Manpower Development and Training Act may be available from the nearest local office of the State employment service.

DIESEL MECHANICS

(D.O.T. 625.281)

Nature of the Work

Diesel mechanics repair and maintain diesel engines that power transportation equipment, such as heavy trucks, buses, boats, and locomotives; and construction equipment, such as bulldozers and cranes. They also service diesel farm tractors and a variety of other diesel-powered equipment, such as compressors and pumps used in oil-well drilling rigs and irrigation.

Before making repairs, diesel mechanics inspect and test engine components to determine why an engine is not operating properly. After locating the trouble, they repair or replace defective parts and make necessary adjustments. Preventive maintenance—avoiding trouble before it starts—is another major responsibility. For example, they may periodically inspect, test, and adjust engine components. Many mechanics make all types of diesel engine repairs. Others specialize, for example, in rebuilding engines or in repairing fuel injection systems, turbochargers, cylinder heads, or starting systems. Some also repair large natural gas engines used to power generators and other industrial equipment.

Diesel mechanics' job titles often indicate the type of equipment they repair. For example, those who repair diesel engines in trucks may be called diesel truck mechanics. Those who work on construction equipment, such as bulldozers and earthmovers, are usually called heavy diesel-equipment mechanics.

In addition to maintaining and repairing engines, the mechanics listed above may work on other parts of diesel-powered equipment, such as brakes and transmissions. (See statement on truck mechanics and bus mechanics elsewhere in the *Handbook*.)

Diesel mechanics use pliers, wrenches, screwdrivers, and other common handtools as well as special tools, such as valve refacers and piston pin-fitting machines. In addition, they may use complex testing equipment, such as a dynamometer to measure engine power, and special fuel injection testing equipment. Mechanics may also use machine tools to make replacement parts. They use powered hoists and other equipment for lifting and moving heavy parts.

Places of Employment

About 90,000 persons worked as diesel mechanics in 1972. Many work for distributors and dealers that sell diesel engines, farm and construction equipment, and trucks. Others work for buslines, construction firms, and government agencies such as State highway departments. Some mechanics work for diesel engine manufacturers and independent repair shops that specialize in diesels.

Diesel mechanics work in all parts of the country. Large numbers, however, are employed in California, New York, Illinois, and Texas—States where high levels of construction, industrial, and farming activity have resulted in the use of large numbers of diesel-powered machines.

Diesel mechanic uses black light to check for oil leaks.

Training, Other Qualifications, and Advancement

Diesel mechanics learn their skills in several different ways. Most begin by repairing gasoline-powered automobiles, trucks, and buses. They usually start as helpers to experienced gasoline engine mechanics, becoming skilled in 3 or 4 years. When employed by firms that use or repair diesel equipment, they receive 6 to 18 months of additional training in servicing this equipment. While learning to fix engines, many find it helpful to take courses in diesel equipment maintenance offered by vocational, trade, and correspondence schools.

Some mechanics, such as those employed by engine manufacturers, learn their trade through formal apprenticeship programs. These programs, which generally last 4 years, give trainees a combination of classroom training and practical experience. Apprentices receive classroom instruction in blueprint reading, hydraulics, welding, and other subjects. In their practical training, they learn about valves, bearings, injection systems, starting systems, cooling systems, and other parts of diesel engines.

Still another method of entry is through full-time attendance at trade or technical schools that offer comprehensive training in diesel engine maintenance and repair. These programs generally last from several months to 2 years and provide practical experience and related classroom instruction. Graduates, however, usually need additional on-the-job training before they become skilled mechanics.

Training programs for diesel mechanics and others in occupations that involve diesel engine repair were in operation in several cities in 1972 under the provisions of the Manpower Development and

Training Act. Unemployed and underemployed workers who meet certain minimum requirements are eligible to apply for this training, which usually lasts at least 36 weeks.

Experienced mechanics employed by companies that sell diesel-powered equipment are sometimes sent to special training classes conducted by engine manufacturers. In these classes, mechanics learn to maintain and repair the latest engines, using the most modern equipment.

Employers prefer trainees and apprenticeship applicants who have a high school education and mechanical ability. Shop courses in automobile repair and machine shop work, offered by many high schools and vocational schools, are helpful, as are courses in science and mathematics. Young people interested in becoming diesel mechanics should be in good physical condition because the work often requires lifting heavy parts.

Many diesel mechanics have to buy their own handtools. Beginners are expected to accumulate tools as they gain experience. Experienced mechanics usually have several hundred dollars invested in their tools.

Mechanics who work for organizations that operate or repair large numbers of diesel engines, such as buslines or diesel equipment distributors, may advance to leadman and to a supervisory position, such as shop foreman or service manager.

Employment Outlook

Employment of diesel mechanics is expected to increase rapidly through the mid-1980's. In addition to the jobs arising from employment growth, many openings will result from the need to replace experienced mechanics who transfer to other occupations, retire, or die.

Increased employment of mechanics is expected mainly because most industries that use diesel engines are expected to expand their activities in the years ahead. In addition, diesel engines will continue to replace gasoline engines. For example, small delivery trucks powered by diesel engines are expected to be used increasingly in the future. Diesel-powered farm equipment also will become more common.

Most new job openings in this field will be filled by mechanics who have experience in repairing gasoline engines. Companies that replace gasoline engine equipment with diesel-powered equipment usually retain their experience mechanics. Persons who have school training in diesel repair, but no practical experience, may be able to find jobs only as trainees.

Earnings and Working Conditions

According to a survey covering metropolitan areas in 1972, mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles had average hourly earnings ranging from $4.29 to $5.29.

Diesel mechanics usually work 40 to 48 hours a week. Many work at night or on weekends, particularly if they work on buses, engines used in powerplants, or other diesel equipment used in serving the public. Some are subject to call for emergencies at any time. Mechanics generally receive a highter rate of pay when they work overtime, evenings, or weekends.

Many diesel mechanics receive paid vacations and holidays. In addition, they may receive health and life insurance benefits, which are at least partially paid by their employers.

Most larger repair shops are pleasant places in which to work, but some small shops have poor lighting, heating, and ventilation. Diesel mechanics sometimes make repairs outdoors where the breakdowns occur. If proper safety precautions are not taken, there is danger of injury when repairing heavy parts supported on jacks or hoists. In most jobs, mechanics handle greasy tools and engine parts. When making repairs, they sometime must stand or lie in awkward positions for extended periods.

Many diesel mechanics belong to labor unions, such as the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the Sheet Metal Workers' International Association; the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

Additional information about work opportunities in this trade may be available from the local office of the State employment service. The State employment service also may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Other sources of information are firms that use or service diesel-powered equipment, such as truck and bus lines, truck dealers, and construction and farm equipment dealers. Unions listed below may be contacted for information on work and training opportunities or for the names and addresses of local unions that can provide such information:

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

Sheet Metal Workers' International Association, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

DISPENSING OPTICIANS AND OPTICAL MECHANICS

(D.O.T. 713.251, .381, .884, and 299.884)

Nature of the Work

Dispensing opticians and optical mechanics (also called optical laboratory technicians) make and fit eyeglasses prescribed by physicians and optometrists. Dispensing opticians adjust finished glasses to fit the customer. In some States, they also fit contact lenses. Optical mechanics grind and polish lenses according to prescriptions and assemble lenses in frames. Occasionally, the jobs of dispensing optician and optical mechanic are combined.

Dispensing opticians determine where lenses should be placed in relation to the customer's eyes by measuring the distance between the centers of the pupils. They also assist the customer in selecting the proper eyeglass frame by measuring the customer's facial features and showing the various styles and colors of frames.

Dispensing opticians prepare work orders that give optical mechanics the information they need to interpret prescriptions properly, grind the lenses, and insert them in a frame. The work orders include lens prescriptions; information on lens size, tint (where appropriate), and optical centering; and frame size, color, and style. After glasses are made, dispensing opticians adjust the frame to the contours of the customer's face and head so that it fits properly and comfortably. Adjustments are made with handtools, such as optical pliers, files, and screwdrivers. A special instrument is used to check the power and surface quality of the lenses. In some shops, dispensing opticians grind and finish lenses, and sell other optical goods such as binoculars and nonprescription sunglasses.

In fitting contact lenses, dispensing opticians follow physicians' or optometrists' prescriptions, measure the corneas of customers' eyes and then prepare specifications to be followed by the lens manufacturers. Contact lens fitting requires considerably more skill, care, and patience than conventional eyeglass fitting. Dispensing opticians tell customers how to insert, remove, and care for contact lenses during the initial adjustment period, which may last several weeks. Physicians or optometrists recheck their fit, as needed. Opticians may make minor adjustments; lenses are returned to the manufacturer for major changes.

Optical mechanics make prescription glasses but not contact lenses. The two types of optical mechanics are *surfacer* (or lens grinder) and *benchman* (or finisher). Starting with standard size lens blanks, which large optical firms mass-produce, surfacers lay out the work and grind and polish the lens surfaces. Surfacers use precision instruments to measure the lenses and assure that they fit the prescription. In small laboratories, one person may do these operations and benchwork too. In large laboratories, work is divided into separate operations which are performed mainly by workers who operate power grinding and polishing machines.

Optician checks lenses.

Benchmen mark and cut lenses and smooth their edges to fit frames. They then assemble the lenses and frame parts into finished glasses. In large laboratories, these duties are divided into several operations which are performed mainly by semiskilled workers. Benchmen use special tools, such as lens cutters and glass drills, as well as small files, pliers, and other handtools. They also use automatic edging machines to shape lens edges, and precision instruments to detect imperfections.

Places of Employment

About 12,000 persons worked as dispensing opticians in 1972, and an additional 16,000 worked as optical mechanics. A few thousand women were in these trades—most as opticians.

Most dispensing opticians work for retail optical shops or department stores and other retail stores that sell prescription lenses. Many

alsc work for eye physicians or optometrists who sell glasses directly to patients. A small number work in hospitals and in prescription departments of wholesale optical laboratories.

Most optical mechanics work in wholesale optical laboratories. The remainder work for the same types of employers as dispensing opticians.

Many dispensing opticians and mechanics are proprietors of retail optical shops.

Jobs in these fields are found in every State. However, employment is concentrated in large cities and in populous States.

Training, Other Qualifications, and Advancement

Most optical mechanics and dispensing opticians learn their skills on the job. On-the-job training in dispensing work may last several years and usually includes instruction in optical mathematics, optical physics, and the use of precision measuring instruments.

Optical mechanic trainees do simple jobs such as processing lenses through a grinding machine. As they gain experience, they progress to other operations such as lens cutting and eyeglass assembly. When the trainees have acquired experience in all types of work, which usually takes about 3 years, they are considered all-round optical mechanics. Some mechanics specialize in one type of job, such as surfacing or bench work. The training time required to become a specialist is less than that needed to become an all-round mechanic.

High school graduates also can prepare for both optical dispensing and mechanical work through 3- to 4-year formal apprenticeship programs. Apprentices with exceptional ability may complete their training in a shorter period. Most training authorities agree that mechanics and opticians who learn as apprentices have more job opportunities and more opportunities for advancement than those without such training.

Formal institutional training for the optician and optical mechanic is becoming more common. In 1972, seven schools offered 2-year full-time courses in optical fabricating and dispensing work leading to an associate degree. In addition, a number of vocational schools offered 9-month full-time optical mechanic courses. Graduates from such schools often work for retail optical stores to receive additional on-the-job training. Large manufacturers of contact lenses offer nondegree courses in lens-fitting that usually last a few weeks. A small number of opticians and mechanics learn their trades in the Armed Forces.

Employers prefer applicants for entry jobs as opticians and optical mechanics to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. The interest and ability to do precision work are essential. Because opticians deal directly with the public, They should be tactful and have pleasant personalities.

The 1972, 17 States had licensing requirements governing dispensing opticians: Arizona, California, Connecticut, Florida, Georgia, Hawaii Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee, Virginia, and Washington. Some of these States also require licenses for optical mechanics in retail optical shops. Some States permit dispensing opticians to fit contact lenses. To obtain a license, the applicant generally must meet certain minimum standards of education and training, and must also pass either a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Optical mechanics can become supervisors, foremen, and managers. Many of them have become dispensing opticians, although the trend is to train specifically for optician jobs. Workers in both occupations, especially those having all-round training in both shop and dispensing work, have opportunities to go into business. Opticians also may manage retail optical stores or sell eyeglasses or lenses for wholesalers or manufacturers.

Employment Outlook

Employment of dispensing opticians and optical mechanics is expected to increase very rapidly through the mid-1980's. In addition to job openings resulting from employment growth, some openings will arise from the need to replace experienced workers who retire, die, or transfer to other occupations.

Demand for prescription lenses is expected to increase as a result of population growth, rising literacy and educational levels, and a large increase in the number of older persons (a group most likely to need glasses). State programs to provide eye care for low-income families, union health insurance plans, and medicare also will stimulate demand. Moreover, the growing variety of frame styles and colors may encourage individuals to buy more than one pair of glasses.

Growth in the demand for prescription lenses will increase employment opportunities both for dispensing opticians and optical mechanics. However, due to more efficient methods of making

lenses, mechanic employment will not increase as rapidly as optician employment.

Earnings and Working Conditions

Hourly wage rates for optical mechanics ranged from $3.10 to $5.54 in 1972, based on information from a small number of union contracts. Dispensing opticians generally earn about 15 to 25 percent more than mechanics.

Apprentices start at about 60 percent of the skilled worker's rate; their wages are increased periodically so that upon completion of the apprenticeship program, they receive the beginning rate for journeymen.

Optical mechanics at wholesale establishments usually have a 5-day, 40-hour week. Dispensing opticians and mechanics at retail shops generally work a 5½- or 6-day week.

Work surroundings of the optical mechanic are pleasant, well-lighted, and well-ventilated, but noisy because of the power-grinding and polishing machines.

Physically handicapped persons who have full use of their eyes and hands can perform some of the more specialized jobs in the larger firms.

Some optical mechanics and dispensing opticians are members of unions. Most belong to the International Union of Electrical, Radio and Machine Workers (AFL-CIO).

Sources of Additional Information

A list of schools offering courses for people who wish to become dispensing opticians or optical mechanics may be obtained from:

Associated Opticians of America, 1250 Connecticut Ave. NW., Washington, D.C. 20036.

General information about these occupations may be obtained from:

American Board of Opticianry, 821 Eggert Rd., Buffalo, N.Y. 14226.

International Union of Electrical, Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

Optical Wholesalers Association, 6935 Wisconsin Ave., Washington, D.C. 20015.

ELECTRIC SIGN SERVICEMEN

(D.O.T. 824.281)

Nature of the Work

Electric sign servicemen maintain and repair hundreds of thousands of neon and illuminated plastic signs that advertise products and businesses. Some also assemble and install signs.

Servicemen diagnose trouble in faulty signs. Minor repairs, such as burned out lamps, are made at sign locations; major overhaul of faulty components, such as a motor, are made in sign shops.

In repairing neon signs, servicemen repaint portions of neon tubing to increase its readability, tighten or weld parts loosened by high winds or dented during erection, and repair small cracks in the face of signs. They also paint beams, columns, and other exterior framework. When replacing burned out parts in illuminated plastic signs, servicemen may refer to wiring diagrams and charts.

Electric sign servicemen also do preventive maintenance. They check signs and remove such things as birds' nests and accumulated water. Also, motors, gears, bearings, and other parts of revolving signs may be checked, adjusted, and lubricated. Servicemen sometimes suggest ways to increase the attractiveness and visibility of signs, such as changing the color of tubing, or raising the height of a sign.

Servicemen use handtools and power tools, such as screwdrivers and electric drills, and test devices such as voltmeters. Their trucks are equipped with ladders and boom cranes.

Servicemen usually must fill out reports by noting the date, place, and nature of service calls. They also may estimate the cost of service calls and sell maintenance contracts to sign owners.

Places of Employment

About 8,000 persons worked as electric sign servicemen in 1972, primarily in small shops that manufacture, install, and service electric signs. Some servicemen also worked for independent sign repair shops.

Electric sign servicemen work in every State. However, employment is concentrated in large cities and in populous States.

Training, Other Qualifications, and Advancement

Most electric sign servicemen are hired as trainees and learn their trade informally on the job. They rotate through the various phases of signmaking to obtain a general knowledge of tasks—such as cutting and assembling metal and plastic signs; mounting neon tubing; wiring signs; and installing electrical parts. At least 3 years on the job are required to become a fully qualified serviceman.

Some servicemen learn their trade through electricians' apprentice programs which last from 3 to 5 years and specialize in signmaking and repairing. Included are on-the-job training and classroom instruction in fields such as electrical theory and blueprint reading. Ap-

Electric sign serviceman installs lamps in illuminated plastic sign.

plicants generally must be between 18 and 25 and have mechanical aptitude and an interest in electricity.

Employers prefer to hire high school or vocational school graduates, although many sign servicemen have less education. Mathematics, science, electricity, and blueprint reading are helpful to young people who are interested in learning this trade.

Servicemen need good color vision because electric wires are frequently identified by color. They also need manual dexterity to handle tools and physical strength to lift transformers, and other heavy equipment.

All electric sign servicemen must be familiar with the National Electric Codes; some also must know local electric codes. Many cities require servicemen to be licensed. Licenses can be obtained by passing an examination in electrical theory and its application. Electric sign servicemen generally purchase their own handtools which may cost up to $100, but employers usually furnish power tools.

Highly skilled servicemen may become foremen. Because of their experience in servicing signs and dealing with customers, servicemen sometimes become sign salesmen. Also, servicemen with sufficient funds can open their own sign manufacturing or repair shops.

Employment Outlook

Employment of electric sign servicemen is expected to increase very rapidly through the mid-1980's. In addition to jobs from employment growth, some openings will arise as experienced servicemen retire, die, or transfer to other occupations.

A rapid increase in the number of signs in use will spur demand for electric sign servicemen. More signs will be needed as new businesses open and old ones expand and modernize their facilities. Signs already in use also will continue to require maintenance. Employment, however, will not increase as rapidly as the number of signs in use. New equipment, such as more versatile boom and ladder trucks, will speed servicing. Pressure cleaning equipment will be substituted for manual methods to increase efficiency.

Earnings and Working Conditions

The earnings of electric sign servicemen compare favorably with those of other skilled workers. Hourly wage rates of experienced electric sign servicemen ranged from $2.76 to $7.80 in 1972, according to a survey of union wages and fringe benefits covering 93 cities. In more than two-thirds of these cities, hourly rates ranged between $4.50 and $6.50. Apprentice rates usually start at about half the journeyman's hourly wage rate and increase every 6 months, to about 90 percent of the journeyman's rate during the final year of apprenticeship.

Most electric sign servicemen work an 8-hour day, 5 days a week, and receive premium pay for overtime. They also may receive extra pay for working at heights in excess of 30 feet. Typically, servicemen receive 1 or 2 weeks of vacation with pay, depending on the length of service, and from 6 to 9 paid holidays a year. In addition, many employers pay part or all of the cost of life, health, and accident insurance; some also contribute to retire-

ment plans. When uniforms are required, the cost usually is partly or entirely paid for by the employer.

Because most signs are out-of-doors, servicemen are exposed to all kinds of weather. They make emergency repairs at night, on weekends, and on holidays. Some patrol areas at night for improperly operating signs. Hazards include electrical shock, burns, and falls from high places. Safety belts, training programs emphasizing safety, and baskets on boom trucks for easy access to signs have reduced the frequency of accidents.

Sources of Additional Information

For further information on work opportunities for electric sign servicemen contact local sign manufacturing shops, the local office of the State employment service, or locals of the International Brotherhood of Electrical Workers.

Additional information on job opportunities, wages, and the nature of the work may be obtained from:

National Electric Sign Association, 600 Hunter Dr., Oak Brook, Ill. 60521.

FARM EQUIPMENT MECHANICS

(D.O.T. 624.281)

Nature of the Work

Farm equipment mechanics service most of the equipment used to plant, cultivate, and harvest food. These craftsmen maintain all types of farm machinery, including tractors, combines, hay balers, corn pickers, crop dryers, elevators, and conveyors. In addition, they may assemble new implements and machinery for farm equipment dealers or wholesalers. Sometimes, they repair dented and torn sheet metal on farm equipment.

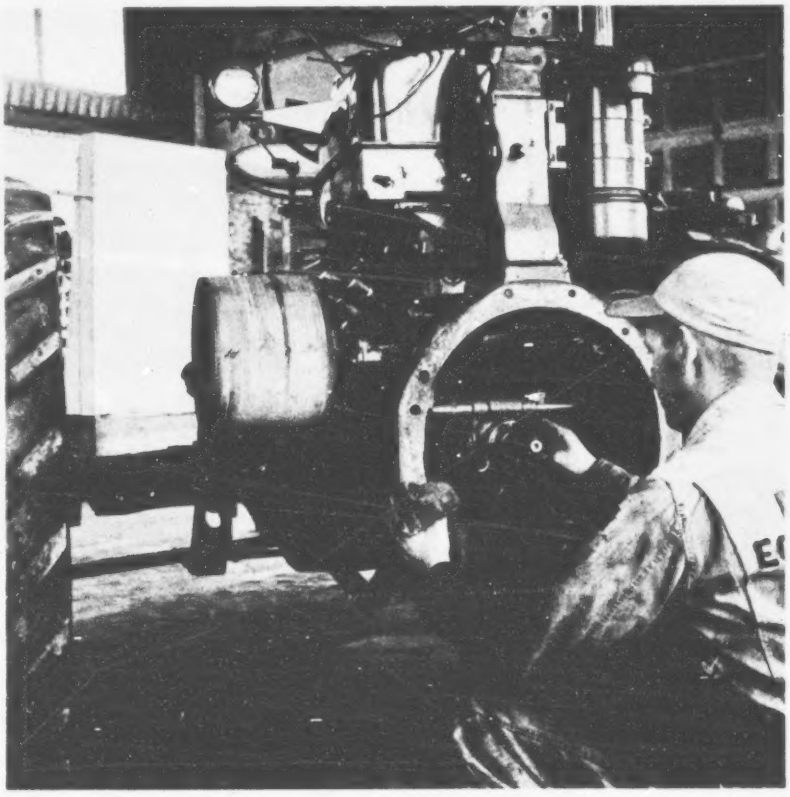
Mechanics spend much of their time repairing and adjusting malfunctioning diesel- and gas-powered tractors which have been brought to the shop. During planting or harvesting seasons, however, the mechanic may travel to the farm to make emergency repairs so that crops can be harvested before they spoil.

Mechanics also perform preventive maintenance. Periodically, they test and clean parts and tune engines. In large shops, mechanics may specialize in certain types of work, such as engine overhaul or clutch and brake repair. They also may specialize in repairing certain types of equipment such as hay balers. Some mechanics also repair plumbing, electrical, irrigation, and other equipment on farms.

Mechanics use many simple handtools including wrenches, pliers, hammers, and micrometers. They also may use more complex testing equipment, such as a dynamometer to measure engine performance, or a compression tester to find worn piston rings or leaking cylinder valves. They may use welding equipment or power metalworking tools to repair broken parts.

Places of Employment

Most of the estimated 47,000 farm equipment mechanics in 1972



Farm equipment mechanic assembles transmission shaft of tractor.

worked in service departments of farm equipment dealers. Other mechanics worked in independent repair shops, in shops on large farms, and in service departments of farm equipment wholesalers and manufacturers. Most farm equipment repair shops employed fewer than five mechanics, although a few dealerships employed more than ten.

Farm equipment mechanics work in all parts of the country. Most, however, are employed in states where agricultural activity is heaviest.

Training, Other Qualifications, and Advancement

Most farm equipment mechanics are hired as helpers, and learn the trade on the job by assisting qualified mechanics. The length of training varies with the helper's aptitude and prior experience. At least 3 years of on-the-job training usually are necessary in order to become a qualified mechanic.

A few mechanics learn the trade by completing an apprenticeship program which lasts from 3 to 4 years and includes on-the-job, as well as classroom training in all phases of farm equipment maintenance. Applicants for these programs usually are chosen from shop helpers.

A small number of farm equipment mechanics have received training in programs approved under the provisions of the Manpower Development and Training Act. Typically, these programs last from 29 to 56 weeks and include basic electricity, transmissions, welding, hydraulics, and diesel engines. Trainees who complete these programs make simple repairs and can qualify as skilled mechanics after some on-the-job experience.

Some farm equipment mechanics and trainees receive refresher training in short-term programs conducted by farm equipment manufacturers. These programs usually last several days. A company representative explains the design and function of equipment, and teaches maintenance and repair on new models of farm equipment.

Employers prefer applicants who have a farm background and an aptitude for mechanical work. Employers also prefer high school graduates, but some will hire young persons who have less education. In general, employers stress previous experience or training in diesel and gasoline engines, hydraulics, and welding—subjects that may be learned in high schools and vocational schools.

Young persons considering careers as farm equipment mechanics should have the strength and manual dexterity to handle tools and equipment. They should also be able to work independently with minimum supervision.

Farm equipment mechanics may advance to shop foreman, particularly if they attend manufacturer-sponsored training sessions. Some open their own repair shops.

Employment Outlook

Employment of farm equipment mechanics is expected to increase slowly through the mid-1980's. In addition to jobs from employment growth, several hundred openings will arise each year as experienced mechanics retire, die, or transfer to other occupations.

An anticipated decline in the number of farms and the increasing reliability of farm machinery are expected to limit the demand for farm equipment mechanics. These limiting factors will be partially offset, however, by increases in farm mechanization, and the greater use of specialized farm equipment such as the tomato harvester. Futhermore, farm operators will find it more economical to have their machinery serviced on a regular basis as farms become larger.

Earnings and Working Conditions

Average hourly wages of farm equipment mechanics ranged from $3 to $4.50 in 1972, based on the limited information available.

Farm equipment mechanics usually work a 44-hour week, which includes 4 hours on Saturday. During planting and harvesting seasons, however, they often work 6 to 7 days each week, 10 to 12 hours daily. In winter months, they may work fewer than 40 hours a week.

Many mechanics receive from 1 to 2 weeks of paid vacation and 7 paid holidays each year. Large shops usually provide health plans and sometimes retirement plans.

Mechanics often travel many miles to repair equipment in the field, and are exposed to all kinds of weather. They come in contact with grease, gasoline, rust, and dirt, and there is danger of injury when they repair heavy parts supported on jacks or by hoists. Engine burns and cuts from sharp edges of farm implements also are possible. Farm equipment mechanics, however, have the opportunity to live and work in rural areas. They also are able to gain satisfaction from seeing the results of their labor.

The few farm equipment mechanics who belong to labor unions are members of the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

Details about work opportunities may be obtained from local farm equipment dealers and local offices of the State employment service.

The State employment service office also may have information about the Manpower Development and Training Act and other training programs. General information about the occupation can be obtained from:

Farm and Industrial Equipment Institute, 850 Wrigley Building N., 410 North Michigan Ave., Chicago, Ill. 60611.

National Farm and Power Equipment Dealers Association, 2340 Hampton Ave., St. Louis, Mo. 63139.

INDUSTRIAL MACHINERY REPAIRMEN

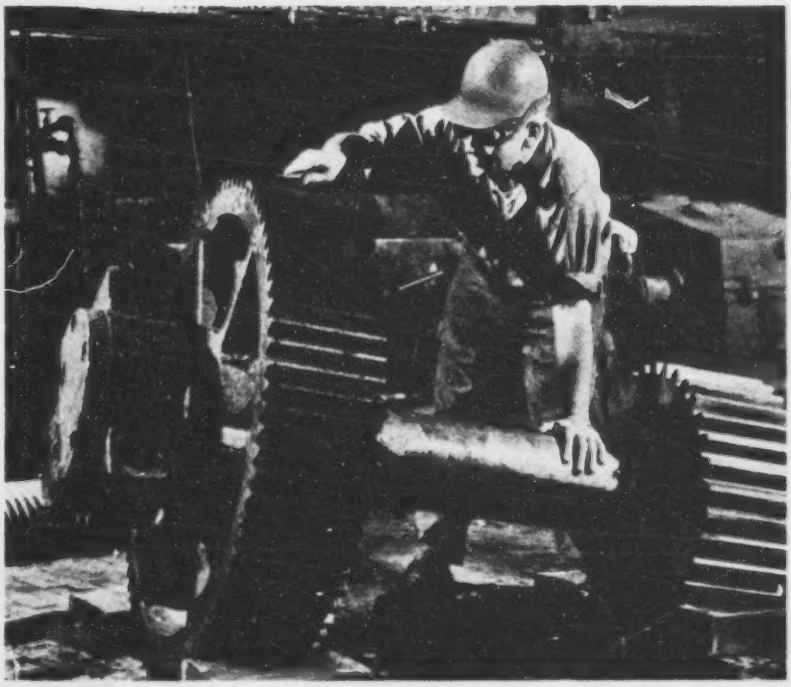
(D.O.T. 626. through 631.)

Nature of the Work

The great variety of machinery and equipment used throughout American industry is kept in good operating condition by industrial machinery repairmen—often called maintenance mechanics. These skilled workers maintain and repair machinery and other mechanical equipment used in many kinds of factories. When breakdowns occur, repairmen must quickly find the causes of trouble and make repairs because delays can interrupt the factory's production.

Repairmen spend much time doing preventive maintenance. By regularly inspecting the equipment, oiling and greasing machines, and cleaning parts, they prevent trouble which could cause breakdowns later. They also may keep maintenance records of the equipment serviced.

The types of machinery serviced by repairmen depend on the industry. For example, in the apparel industry, they may repair belts, adjust treadles, or replace motor bearings in industrial sewing machines. In printing plants, repairmen maintain the presses.



Repairman cleans rolling mill gear.

Repairmen often follow blueprints, lubrication charts, and engineering specifications in maintaining and repairing equipment. They also may use catalogs to order replacements for broken or defective parts. When parts are not readily available, or when a machine must be quickly returned to production, repairmen may sketch a part that can be fabricated by the plant's machine shop.

Industrial machinery repairmen use wrenches, screwdrivers, pliers, and other handtools, as well as portable power tools. They also may use welding equipment in repairing broken metal parts.

Places of Employment

Repairmen work in almost every industrial plant that uses large amounts of machinery. However, many of the 430,000 repairmen employed in 1972 worked in the following industries: food products, primary metals, machinery, chemicals, fabricated metal products, and transportation equipment. Many repairmen also were employed in the paper and rubber industries.

Because industrial machinery repairmen work in a wide variety of plants, they are employed in every section of the country. The largest numbers of these workers are found in New York, Pennsylvania, California, Ohio, Illinois, Michigan, New Jersey, Massachusetts, and other heavily industrialized States.

Training, Other Qualifications, and Advancement

Most workers who become in-

dustrial machinery repairmen start as helpers and pick up the skills of the trade informally, through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of both on-the-job training and related classroom (or correspondence school) instruction in subjects such as shop mathematics, blueprint reading, and welding.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility also are necessary because repairmen sometimes have to lift heavy objects or do considerable climbing in order to reach equipment located high above the floor.

High school courses in mechanical drawing, mathematics, and blueprint reading are recommended for those interested in entering this trade.

Employment Outlook

Employment of industrial machinery repairmen is expected to increase rapidly through the mid-1980's. In addition to jobs that become available from employment growth, many openings will result from the need to replace experienced repairmen who retire, die, or transfer to other occupations.

More repairmen will be needed to take care of the growing amount of machinery used in manufacturing. In addition, as automatic equipment and continuous production lines become more widespread, repair work and preventive maintenance will become more essential.

Earnings and Working Conditions

Average hourly earnings of industrial machinery repairmen in manufacturing industries in 13 metropolitan areas that were surveyed in 1972–73 are shown in the following tabulation:

Metropolitan area	*Hourly rate*
Baltimore	$5.10
Boston	4.70
Chicago	5.07
Detroit	5.88
Houston	3.96
Miami	4.86
Minneapolis-St. Paul	4.94
New York	4.91
Phoenix	5.01
Pittsburgh	4.89
San Francisco-Oakland	5.69
Seattle-Everett	5.39
South Bend	4.60

Apprentices usually begin at 50 percent of the journeyman rate and receive periodic increases until that rate is reached.

Industrial machinery repairmen are not usually affected by seasonal changes in production. During slack periods, when some plant workers are laid off, repairmen are often retained. Many companies have repairmen do major overhaul jobs during such periods.

In emergencies, industrial machinery repairmen may be called to the plant during off-duty hours. In some factories, repairmen may work nights and weekends.

Repairmen may work in stooped or cramped positions in limited space or from the tops of ladders, and are subject to common shop injuries such as cuts and bruises. Accidents have been reduced, however, by the use of goggles, metal-tip shoes, safety helmets, and other protective devices.

Most industrial machinery repairmen belong to labor unions. Some of the unions in this field are the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Union of Electrical, Radio and Machine Workers. Most union contracts provide for paid holidays and vacations, health and life insurance, retirement pensions, and other fringe benefits.

Sources of Additional Information

Information about employment opportunities in this field may be available from local offices of the State employment service.

INSTRUMENT REPAIRMEN

(D.O.T. 710.131, 710.281, 729.281, 823.281, and 828.281)

Nature of the Work

Instrument repairmen service instruments that are used to measure, record, analyze, and control product output in nearly all areas of research and industry. Most repairmen service a variety of instruments; others specialize in electronic, hydraulic, or pneumatic instruments. Some repairmen install and test new instruments and advise operators on how to use and care for them.

Instrument repairmen perform preventive maintenance by correcting weakened or defective parts that might break down and cause production losses. They also clean, lubricate, and adjust instruments.

When an instrument-controlled system is not working correctly, repairmen determine whether the trouble is caused by the instrument or by other equipment. They may take apart faulty instruments and examine and test the parts for defects. They use testing equipment, such as pressure and vacuum gauges, speed counters, voltmeters, ammeters, and oscilloscopes. Readings shown on test equipment are compared with readings that would be

shown if the instruments were operating properly.

Repairmen work at the site of trouble or in repair shops. They may perform major overhauls, replace worn or damaged parts, or make minor repairs, such as resoldering loose connections. They use handtools such as screwdrivers and wrenches, and bench tools such as jeweler's lathes, pin vises, and ultrasonic cleaners for small metal parts. In some companies, they operate drill presses, polishers, and other machine tools to make new parts or to change standard parts to fit particular instruments. When an instrument must be set very precisely, they may use jeweler's loupes, micrometers, or microscopes. Repairmen frequently use instruction books, maintenance manuals, diagrams, and blueprints.

Places of Employment

More than 100,000 persons worked as instrument repairmen in 1972. Most of them worked for gas and electric utilities, petroleum and chemical plants, and manufacturers of instruments and industrial controls. Large numbers of instrument repairmen also worked for airlines and manufacturers of pulp and paper, metals, rubber, aircraft and missiles, and automobiles. A few thousand worked for Federal agencies, mainly the Air Force, Navy, and Army.

Training, Other Qualifications, and Advancement

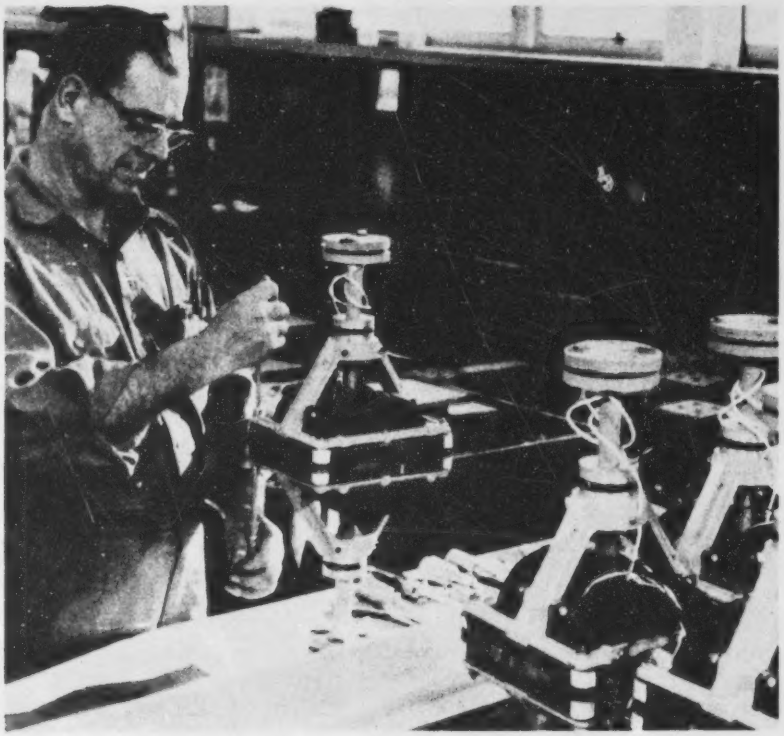
At least 4 years of on-the-job training and study are usually required in order to become an instrument repairmen. However, training time depends upon individual ability, previous experience and training, and complexity of the instruments serviced.

Instrument repairmen generally are selected from production employees or hired as trainees. They may learn their trade informally on the job or through formal apprenticeship. Apprenticeship programs generally last 4 years and, in addition to work experience, may include instrumentation theory, mathematics, blueprint reading, physics, electronics, and chemistry. These courses may be taken by correspondence or at local schools.

Some people train for instrument repair work in technical institutes and junior colleges. Programs offered by these schools usually last 2 years and emphasize basic engineering courses, science, and mathematics. As instruments become more complex, technical school training will become more important and young people with this kind of training will have better advancement opportunities.

Armed Forces technical schools also offer training in instrument servicing. Skills acquired in this way may help a person qualify for a civilian job as an instrument repairman. A small number of unemployed and underemployed workers receive training in general instrument repair or in specialized electronic instruments under the Manpower Development and Training Act.

Several instrument manufacturers offer specialized training to experienced repairmen employed by their customers. This training generally lasts from 1 week to 9 months, depending upon the number and complexity of the instruments. Courses are given in theory, maintenance, and operation of the instruments produced by these manufacturers. Instrument repairmen also keep up



Instrument repairman uses hand tools for final adjustments.

with new developments in their field by reading trade magazines and manufacturers' service manuals.

Trainees or apprentices generally must be high school graduates. Courses in algebra, trigonometry, physics, chemistry, electronics, machine shop, and blueprint reading are considered particularly useful. Some employers give tests to applicants to determine their mechanical aptitude. Good eye-hand coordination and finger dexterity are needed to handle delicate parts. The ability to work without close supervision also is important. Building and maintaining a ham radio station or a stereo is good experience for an individual planning to become an instrument repairman, at least for electronic instrumentation.

Instrument repairmen having supervisory ability may become foremen in maintenance and repair departments. Some may advance to positions as service representatives for instrument manufacturers. A few instrument repairmen become engineering assistants. A basic knowledge of electronics increases advancement possibilities because of the growing use of electronic circuitry in instruments.

Employment Outlook

Employment of instrument repairmen is expected to increase rapidly through the mid-1980's. In addition to jobs due to growth, a few thousand openings will result annually from the need to replace experienced repairmen who retire, die, or transfer to other occupations.

Additional instrument repairmen will be needed because the use of instruments is expected to increase, particularly in areas such as oceanography, pollution monitoring, and medical diagnosis. Industrial instruments for process control in industries such as petroleum, steel, chemicals, food, and rubber also are expected to increase substantially. In addition, more instruments will be needed for research laboratories, aircraft and missiles, automotive repair shops, and optical applications. The anticipated U.S. conversion to international units of measure will require altering and recalibrating instruments to the metric system. This conversion will largely be done by instrument repairmen.

Earnings and Working Conditions

Several union contracts in the paper and petroleum industries indicated that many instrument repairmen received between $3.81 and $5.29 an hour in 1972. Those specializing in the repair of electronic instruments often receive higher wages. Instrument repairmen employed by Federal agencies receive about the same rates as those in private industry.

Most instrument repairmen work a 40-hour, 5-day week. Those employed in plants that operate around-the-clock may work on any of three shifts or rotate among shifts. Repairmen also may be called to work with emergency crews nights, Sundays, and holidays. They receive premium pay for night and holiday work, and most companies provide holiday and vacation pay. Many companies provide additional employee benefits, such as health and life insurance and retirement pensions.

Work settings for instrument repairmen vary from factory floors amid noise, heat, and fumes to quiet, clean well-lighted shops.In some industries, such as chemicals, petroleum, and steel, repairmen may have to work outdoors. Those employed by instrument manufacturers may travel frequently.

Many instrument repairmen belong to unions, including the International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; International Chemical Workers Union; International Union of Electrical, Radio and Machine Workers; International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; Oil, Chemical and Atomic Workers International Union; United Steelworkers of America; and Utility Workers Union of America.

Sources of Additional Information

The local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities for persons who wish to enter this occupation. Additonal information about training and employment opportunities is available from:

Instrument Society of America, 400 Stanwix St., Pittsburgh, Pa. 15222.

Scientific Apparatus Makers Association, 1140 Connecticut Ave. NW., Washington, D.C. 20036.

Inquiries concerning positions with the Federal Government should be made at the regional offices of the U.S. Civil Service Commission.

JEWELERS

(D.O.T. 700.281 and .381)

Nature of the Work

Jewelers make rings, pins, necklaces, and other precious jewelry. These craftsmen also may do repair

work such as enlarging and reducing rings, resetting stones, and soldering broken parts. The jeweler's work is very delicate and must be done with care and precision because materials usually are expensive.

Jewelers follow either their own designs or those created by designers. They outline the design on metal such as gold or silver, and then cut, fit, and shape each part. After polishing, they solder parts together to form the finished piece. Jewelers then carve designs in the metal and mount rubies, opals, or other stones. When doing very precise work, they use a magnifying glass or eye "loupe."

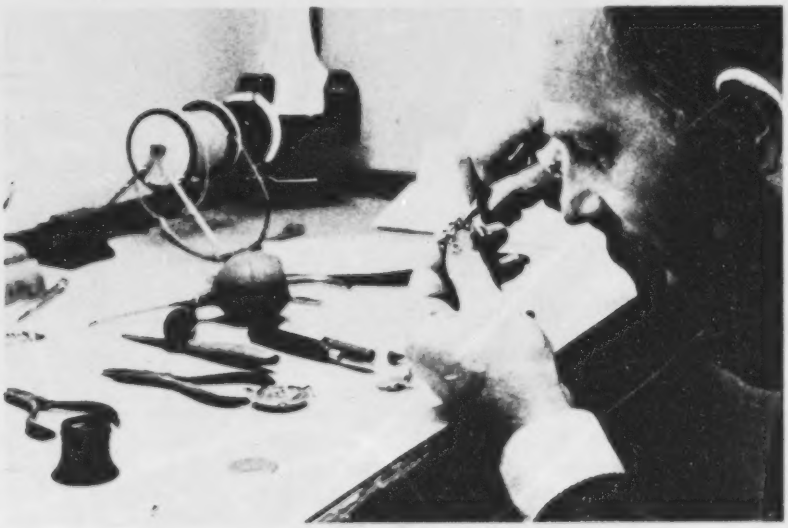
As a rule, jewelers specialize in a particular kind of jewelry, or in a particular operation, such as model making, designing, polishing, or stone setting. With years of experience some develop all-round skills and are capable of making and repairing any kind of jewelry.

Costume jewelry and some kinds of precious jewelry are mass-produced by factory workers using assembly line methods. The metal usually is melted and cast in a mold or shaped with a die. Skilled jewelers are needed, however, to perform finishing operations, such as engraving and stone setting.

Many jewelers own jewelry stores or shops that make and repair jewelry. In addition to working on jewelry, these small businessmen hire employees, order and sell merchandise, and handle other managerial duties.

Places of Employment

About half of the 18,000 jewelers employed in 1972 owned retail jewelry stores and repair shops. The remainder worked in jewelry stores, repair shops, and factories. Nearly one-half of all precious jewelry factories are located in New York, Rhode Island, Massachusetts, New Jersey, and California. The New York City metropolitan area is the center of precious jewelry manufacturing.



The jeweler's work is very delicate.

Training, Other Qualifications, and Advancement

Jewelers' skills can be learned through informal on-the-job training or formal apprenticeship programs. Beginners usually can qualify as jewelry repairmen after about a year on the job. Depending on the particular skill to be learned, apprenticeship programs for jewelry makers usually take from 3 to 4 years. For example, 3 years are required in order to become a colored-stone setter and 4 years to qualify as a diamond setter. Apprenticeship programs include on-the-job training as well as classroom instruction in design, quality of precious stones, chemistry of metals, and related subjects.

Jewelry factories offer the best opportunities for a young person to acquire all-round skills. Repair shops also offer training opportunities, but their small size—many employ only one or two persons—limits the number of trainees.

A high school education is desirable for young people entering the trade. Courses in chemistry, mechanical drawing, and art are particularly useful. A small number of trade schools offer courses in jewelry repair.

The precise and delicate nature of jewelry work requires finger and hand dexterity, good eye-hand coordination, patience, and concentration. People working with precious stones and metals must be bonded and investigated for honesty, trustworthiness, and respect for the law.

In manufacturing, jewelry workers can advance to foremen; in stores, they may become managers. Some jewelers open their own jewelry stores or repair shops.

A substantial financial investment is required in order to open a jewelry store, and the field is highly competitive. Jewelers who plan

Occupation	Average hourly earnings	Minimum hourly job rate
Jewelers—handmade work	$6.00–6.50	$4.50
Modelmakers	7.50–8.00	4.55
Stone setters:		
Diamonds—handmade work	6.50–7.00	4.75
production	6.00–6.50	4.50
Colored stones—handmade work	6.00–6.50	4.20
production	6.00	4.05
Engravers	5.00	4.00
Polishers	5.00	4.00
Toolmakers	6.50	4.55

to open their own stores should have experience in selling jewelry. Those who can repair watches have an advantage, since watch repairs account for much of the business in small stores.

Employment Outlook

Employment of jewelers is expected to show little or no change through the mid-1980's. However, several hundred job openings will occur each year as experienced workers retire, die, or transfer to other occupations.

The demand for jewelry will increase as population grows, and as rising incomes encourage people to spend more on luxuries. Most of the demand, however, will be for costume jewelry. Since most costume articles are mass-produced by semiskilled factory workers and are seldom worth repairing, the demand for jewelers is not expected to grow significantly.

Earnings and Working Conditions

According to limited information available, weekly earnings of experienced jewelers ranged from $175 to $250 a week in 1972 in jewelry stores and repair shops. Beginners earned about $125 a week. Those in business for themselves earned much more. Most jewelers in stores and repair shops work 40 to 48 hours a week.

A union contract covering several New York City jewelry factories in 1972 provided the minimum hourly rates shown in the accompanying table for workers in various jobs. Average hourly rates also are shown.

Under this contract, employees have a 35-hour workweek and are paid time and one-half for all work done before or after the regular workday.

Jewelry work is sometimes recommended for the physically handicapped since the employee is seated and exerts little energy.

Sources of Additional Information

Information on job opportunities in jewelry stores may be obtained from:

Retail Jewelers of America, Inc., 1025 Vermont Ave. NW., Washington, D.C. 20005.

Information on opportunities in jewelry manufacturing may be obtained from:

Manufacturing Jewelers and Silversmiths of America, Inc., Sheraton-Biltmore Hotel, Room S-75, Providence, R.I. 02902.

LOCKSMITHS

(D.O.T. 709.281)

Nature of the Work

Locksmithing is an ancient trade— so old, in fact, that archeologists have found evidence of key-operated wooden locks made for Egyptian royalty as early as 2000 B.C. For many centuries, the locksmith's talents were available to only a relatively few who could afford the locks of the day, sometimes elaborate, if none too foolproof. In 1861, the pin tumbler lock was invented and a mass-production method developed that made these locks nearly as common as doors themselves. The locksmith came into demand as never before.

Today's locksmiths spend much of their time helping people who have locked themselves out of their cars, homes, and businesses. If the key has been left inside the car or house, for example, they may simply pick the lock. If, on the other hand, the keys are lost, new ones must be made. To do this, the locksmith will first try to obtain identifying key code numbers so that he can cut duplicates of the original key. Code numbers for a car's keys, for example, may be obtained by consulting the dealer who sold the car, or by checking the owner's bill of sale. Keys also can be duplicated by impression. In this case, the locksmith places a blank key in the lock and, by following marks left on the blank, files notches in it until it works.

Combination locks offer a special challenge. Locksmiths sometimes open them by touch, that is, by rotating the dial and feeling the vibrations when the wheels come into place. If all else fails, a hole may be drilled through the lock to open it. Finally, locksmiths repair damaged locks by replacing tumblers, springs, and other parts.

As a security measure, many firms periodically have their locks rekeyed. To do this, locksmiths change the locking mechanism to fit new key codes, thus making the old keys useless. Rekeying a master system is one of the most complicated and time consuming jobs handled by a locksmith. In a master system, some keys must open all doors; others open various combinations (for example, all doors on one floor); still others are individual keys for each door.

Some locksmiths install and repair electronic burglar alarms and surveillance systems which signal police or firemen when break-ins or fires occur. A basic knowledge of electricity and electronics is needed to install and repair these systems. Much of the work is done by specialists called protective-signal repairmen, rather than by locksmiths.

Locksmiths use screwdrivers, pliers, tweezers, and electric drills in their work, as well as special tools such as lockpicks. They make original and duplicate keys on key-cutting machines. To guide them in their work, they refer to manuals that describe the construction of various locks.

Places of Employment

Most of the estimated 8,000 locksmiths in 1972 were employed in locksmith shops. Many operated their own businesses. Locksmith shops typically employ one to three locksmiths; few employ more than five. Some locksmiths worked in hardware and department stores that offered the public locksmith services; other worked in government agencies and large industrial plants. A small number worked for safe and lock manufacturers.

Although most jobs will be found in big cities, locksmiths work in virtually every part of the country. Locksmithing in small towns, however, is usually a part-time job, often combined with other work, such as fixing lawn mowers, guns, and bicycles.

Locksmith changes safe's combination.

Training, Other Qualifications, and Advancement

The skills of this trade are learned primarily through on-the-job training. Experienced locksmiths are the teachers. First, beginners may learn to duplicate keys and make keys from codes. Later, they learn to open, repair, and install locks, and, finally, to work on safes. Generally, a beginner needs about 4 years of on-the-job training to qualify as a locksmith. Additional training is needed to service electronic security systems.

Employers look for young people who have mechanical aptitude, good hand-eye coordination, and manual dexterity. A neat appearance and a friendly, tactful manner also are important, since the locksmith has frequent contacts with the public. Employers usually will not hire applicants who have been convicted of crimes.

Although high school graduates are preferred, many employers will hire applicants with less education. High school courses in machine shop, mechanical drawing, and mathematics are helpful. Completion of a correspondence school course in locksmithing increases the chances of getting a trainee job.

Locksmiths' training programs for unemployed and underemployed workers were in operation in a small number of cities in 1972, under provisions of the Manpower Development and Training Act (MDTA). Graduates can qualify as skilled locksmiths after additional on-the-job training.

Some cities require locksmiths to be licensed. To obtain a license, the applicant generally must be fingerprinted and pay a fee. However, specific requirements vary from city to city. Information on licensing may be obtained from local governments.

To keep up with new developments in their field, locksmiths may read monthly technical journals. Another method is attendance at training classes at the annual convention of Associated Locksmiths of America. Here, they may update their knowledge of security devices and learn how to install and repair new ones.

Locksmiths can advance to supervisory positions as shop foremen—positions found, however, only in the larger shops. Experienced locksmiths also can go into business for themselves with relatively little capital. Many do business from their homes.

Employment Outlook

Employment in this relatively small occupation is expected to increase moderately through the mid-1980's. The need to replace experienced workers who retire or die will create almost as many job openings as employment growth. Additional openings will arise as some locksmiths transfer to other occupations.

Employment of locksmiths will increase as a result of population and business growth, and a more security conscious public. Opportunities will be particularly favorable for locksmiths who know how to install and service electronic security systems. Use of such systems has expanded greatly in recent years, and still greater growth is expected in the future.

Earnings and Working Conditions

Experienced locksmiths earned from $4 to $6 an hour in early 1972, according to the limited information available; many self-employed locksmiths earned even more. Trainees usually started at about $2 an hour, with periodic raises during training.

Most locksmiths receive an hourly rate or weekly salary, although some work on a commission basis, receiving a percentage of the money they collect; their earnings depend on the amount of work available and how quickly they complete it. Fringe benefits vary, including in some cases, holidays and vacation pay, laundered uniforms free of charge, employer contributions to life, health, and accident insurance, and paid sick leave.

Locksmiths generally work year-round. Most work 40 to 48 hours a week; even longer hours are common among the self-employed. The locksmith may be called at night to handle emergencies, though in many shops the responsibility to be "on call" is rotated among the staff.

Locksmiths do considerable driving from job to job. At times, they must work outside in bad weather and occasionally work in awkward positions for long periods. However, locksmithing is cleaner work than that of most mechanical trades and is comparatively free from the danger of injury.

Sources of Additional Information

Details about training and work opportunities may be available from local locksmith shops and local offices of the State employment service. General information about the occupation can be obtained from:

Associated Locksmiths of America, Inc., 11 Elmendorf St., Kingston, N.Y. 12401.

MAINTENANCE ELECTRICIANS

(D.O.T. 825.281 and 829.281)

Nature of the Work

Maintenance electricians keep lighting systems, transformers, generators, and other electrical equipment in good working order. They also may install new electrical equipment.

Duties vary greatly, depending on where the electrician is employed. Electricians who work in large factories may repair particular items such as motors and welding machines. Those in office buildings and small plants usually fix all kinds of electrical equipment. Regardless of location, electricians spend much of their time doing preventive maintenance—periodic inspection of equipment to locate and correct defects before breakdowns occur. When trouble occurs, they must find the cause and make repairs quickly to prevent costly production losses. In emergencies, they advise management whether continued operation of equipment would be hazardous, necessitating a shutdown.

Maintenance electricians make repairs by replacing items such as fuses, circuit breakers, or switches. When installing new or replacing existing wiring, they splice wires and cut and bend conduits (pipes) through which the wires are run.

Maintenance electricians sometimes work from blueprints, wiring diagrams, or other specifications. They use ammeters, volt-ohm meters, and other testing devices to locate faulty equipment. To make repairs they use pliers, screwdrivers, wire cutters, drills, and other tools.

Places of Employment

An estimated 260,000 maintenance electricians were employed in 1972. More than half of these craftsmen worked in manufacturing industries; large numbers worked in plants that make automobiles, machinery, chemicals, aluminum, and iron and steel. Many maintenance electricians also were employed by public utilities companies, mines, railroads, and by Federal, State, and local governments.

Maintenance electricians are employed in every State. Large numbers work in heavily industrialized States such as California, New York, Pennsylvania, Illinois, and Ohio.

Training, Other Qualifications, and Advancement

Maintenance electricians learn their skills on the job or through formal apprenticeship programs. Training authorities generally agree that apprenticeship gives trainees more thorough knowledge of the trade and improved job opportunities during their working life.

Apprenticeship programs for maintenance electricians usually last 4 years. Apprentices are given on-the-job training and related classroom instruction in subjects such as mathematics, electrical and electronic theory, and blueprint reading. Training may include motor repair, wire splicing, installation and repair of electronic controls and circuits, and welding and brazing.

A young person employed as a helper to a skilled maintenance electrician can gradually learn the skills of the craft by observing the electrician and following instructions. Others learn the fundamentals of the trade by moving from job to job in the maintenance department of a plant; they eventually get enough experience to qualify as skilled maintenance electricians. This method of learning the trade, however, may take more than 4 years.

Young people interested in becoming maintenance electricians should include courses in mathematics (such as algebra and trigonometry) and basic science in their high school or vocational school curriculum. Because the electrician's craft is subject to constant technological change, many experienced electricians continue to learn new skills. For example, some maintenance electricians who entered the trade years ago must now learn basic electronics.

In selecting apprentice applicants or trainees, employers look for young people who have manual dexterity and are interested in learning how electrical equipment functions. Applicants also need good color vision because electrical wires are frequently identified by color. Although physical strength is not essential, agility and good health are important.

All maintenance electricians should be familiar with the National Electric Code and local building codes. Many cities and counties require maintenance electricians to be licensed. Electricians can get a license by passing an examination that tests their knowledge of electrical theory and its application.

Some maintenance electricians become foremen. Occasionally, they advance to jobs such as plant electrical superintendent or plant maintenance superintendent. After additional training, maintenance electricians also can become construction electricians.

Maintenance electrician checks circuit.

Employment Outlook

Employment of maintenance electricians is expected to increase moderately through the mid-1980's because of the growing amount of electrical and electronic equipment used in industry. In addition to the jobs from employment growth, a few thousand openings will arise each year to replace experienced electricians who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Earnings of maintenance electricians compare favorably with those of other skilled manufacturing workers. In early 1972, maintenance electricians averaged $4.96 an hour, ranging from $3.40 in Manchester, N.H. to $5.79 in Chicago, based on a survey of 88 cities. In about three-fourths of the cities surveyed, hourly averages for these craftsmen ranged from $4 to $5.25.

Apprentices start at about 60 percent of the journeyman's basic hourly pay rate. They receive increases every 6 months, and rise to 85 or 90 percent of the journeyman's rate during the last period of apprenticeship.

During a single day, a maintenance electrician may repair equipment in a clean air-conditioned office and on the factory floor, surrounded by the noise, oil, and grease of machinery. Electricians often climb ladders or work on scaffolds in awkward or cramped positions.

Because maintenance electricians work near high-voltage industrial equipment, they must be alert and accurate. Errors in wiring installations could have dangerous consequences, both to the electrician and other employees. Safety principles, which are a part of all electrician training programs, have reduced the frequency of accidents. Electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to fight small electrical fires.

Among unions organizing maintenance electricians are the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (Ind.); and the United Steelworkers of America. Most union contracts provide major benefit programs that may include paid holidays and vacations, health and life insurance, and retirement pensions.

Sources of Additional Information

Young people who wish to obtain further information about electrician apprenticeships or other work opportunities in the trade should apply to local firms that employ maintenance electricians; to a local joint union-management apprenticeship committee, if one is in the locality; or to the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may provide information about training opportunities. Some State employment service offices screen applicants and give aptitude tests.

MOTORCYCLE MECHANICS

(D.O.T. 620.281 and .384)

Nature of the Work

More than 3 million Americans own motorcycles and motor scooters. Although many cycling enthusiasts repair their own vehicles, most rely on skilled mechanics.

Motorcycles, like automobiles, need periodic servicing to operate at peak efficiency. Spark plugs, ignition points, brakes, and many other parts that frequently get "out of whack" have to be adjusted or replaced. This routine servicing represents the major part of the mechanic's work.

The mark of a skilled mechanic is his ability to diagnose mechanical and electrical problems and to make necessary repairs in a minimum of time. In diagnosing problems, the mechanic first obtains a description of the symptoms from the motorcycle owner, and then runs the engine or test rides the machine. He may have to use special testing equipment and disassemble some components for further examination. Once he has pinpointed the problem, he makes needed adjustments or replacements. Some jobs require only the replacement of a single item, such as a carburetor or generator, and may be completed in less than an hour. In contrast, an overhaul may require several hours, because the mechanic must disassemble and reassemble the engine to replace worn valves, pistons, bearings, and other internal parts.

Mechanics use common handtools such as wrenches, pliers, and screwdrivers, as well as special tools for getting at "hard to remove parts" such as flywheels and bearings. They also use compression

Mechanic repairs motorcycle kick starter.

gauges, timing lights, and other kinds of testing devices. Hoists are used to lift heavy motorcycles.

Most mechanics specialize in servicing only a few of the more than 30 brands of motorcycles and motor scooters. In large shops, some mechanics specialize in overhauling and rebuilding engines and transmissions, but most are expected to perform all kinds of repairs. Mechanics may occasionally repair mini-bikes, go-carts, snowmobiles, outboard boat motors, lawn mowers, and other equipment powered by small gasoline engines.

Places of Employment

Nearly all of the estimated 9,500 full-time and 3,000 part-time motorcycle mechanics employed in late 1972 worked for motorcycle dealers. Most of the remainder maintained police motorcycles for municipal governments. A small number of mechanics were employed by firms that specialized in modifying or "customizing" motorcycles. Most shops employ less than five mechanics.

Motorcycle mechanics are employed in every State and every major city. About one-half worked in 9 States: California, Michigan, Texas, Ohio, Pennsylvania, Illinois, Florida, Minnesota, and Indiana.

Nearly all mechanics who specialize in repairing motorcycles are employed in cities having more than 30,000 population. In smaller cities, motorcycles frequently are repaired by the owner or manager of the dealership that sells that particular make, or by mechanics who repair all kinds of equipment powered by small gasoline engines.

Training, Other Qualifications, and Advancement

Motorcycle mechanics usually learn their trade on the job, picking up skills from experienced workers. Initially, a trainee learns to uncrate, assemble, and road test new motorcycles. Next, he learns routine maintenance jobs such as adjusting brakes, spark plugs, and ignition points. As the trainee gains experience, he progresses to more difficult tasks such as repairing electrical systems and overhauling engines and transmissions. Generally, 2 to 3 years of training on the job are necessary before a trainee becomes a fully qualified mechanic.

A trainee is expected to accumulate handtools as he gains experience. Mechanics usually have several hundred dollars invested in tools.

Employers sometimes send mechanics and experienced trainees to special training courses conducted by motorcycle manufacturers and importers. These courses, which may last as long as 2 weeks, are designed to upgrade the worker's skills and provide information on repairing new models.

When hiring trainees, employers look particularly for cycling enthusiasts who have gained practical experience by repairing their own motorcycles. However, many employers will hire trainees with no riding experience if they have mechanical aptitude and show an interest in learning the work. Trainees must be able to obtain a motorcycle driver's license.

Most employers prefer high school graduates, but will accept applicants with less education. Courses in small engine repair—offered by some high schools and vocational schools—generally are helpful, as are courses in automobile mechanics, science, and mathematics. Many motorcycle dealers employ students to help assemble new motorcycles and perform minor repairs.

Public schools in some large cities offer post-secondary and adult education in small engine and motorcycle repair. Some technical schools have training programs for motorcycle mechanics. Many junior and community colleges offer courses in motorcycle repairing. Some unemployed and underemployed workers have received training in small engine repair under the Manpower Development and Training Act.

Skills learned through repairing motorcycles can be transferred to other fields of mechanical work. For example, since all internal combustion engines are similar, a motorcycle mechanic can become an automobile or diesel mechanic after some additional training. However, such a transfer would not necessarily mean higher earnings.

Motorcycle mechanics have limited advancement possibilities. Those with supervisory ability may advance to service manager and, eventually, to general manager in large dealerships. Those who have

the necessary capital may become dealers.

Employment Outlook

Employment in this relatively small occupation is expected to grow rapidly through the mid-1980's. Many additional openings will arise from the need to replace experienced mechanics who retire, die, or transfer to other fields of work.

Underlying the anticipated growth in the number of motorcycle mechanics is the continued growth in the number of motorcycles in use. Increases in the young adult population and in personal income levels will create a demand for more motorcycles, and additional mechanics will be needed to maintain these machines. Also, growth in the numbers of mini-bikes and snowmobiles will stimulate the demand for mechanics.

Maintenance requirements per motorcycle may rise as a result of a trend toward use of higher powered, more complex engines. However, this favorable employment effect will probably be offset by increases in mechanic efficiency brought about by improved training methods, better shop management, and greater use of special tools and test equipment. Also, improved ignition systems and overall motorcycle design could lengthen the intervals between routine servicing and major repairs, as well.

Earnings and Working Conditions

Earnings of motorcycle mechanics and trainees vary widely and depend on level of skill, geographic location, and employer. Limited information indicates that experienced mechanics employed by motorcycle dealers earned between $3 and $10 an hour in late 1972. Generally experienced mechanics earned 2 to 3 times as much as trainees.

Some mechanics are paid an hourly rate or a weekly salary. Others are paid a percentage—usually about 50 percent—of the labor cost charged to the customer. If a mechanic is paid on a percentage basis, his salary depends on the amount of work he is assigned and how rapidly he completes it. Frequently, trainees are paid on a piecework basis when uncrating and assembling new motorcycles. At other times, they are paid an hourly rate or weekly salary.

Motorcycling increases sharply as the weather grows warmer. Consequently, most mechanics work more than 40 hours a week during the summer. Many temporary workers hired to help handle the increased work load work only part time, and are laid off in the fall. However, a large proportion of these are either students or workers having full-time jobs elsewhere.

Many motorcycle mechanics receive holiday and vacation pay and additional benefits such as life, health, and accident insurance. Some also receive paid sick leave, contributions to retirement plans, and laundered uniforms. Mechanics who work for dealers may receive discounts on purchases of accessories, parts, and motorcycles, although most dealers try to discourage this as a reason for working.

Motorcycle shops generally are well-lighted and ventilated, but are noisy when engines are being tested. The work is not hazardous, although mechanics are subject to cuts, bruises, and other minor injuries. Since motorcycles are relatively lightweight and have easily accessible parts, mechanics rarely do heavy lifting or work in awkward positions.

A small percentage of motorcycle mechanics are members of the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

For further information regarding employment opportunities and training for motorcycle mechanics, contact local motorcycle dealers or the local office of the State employment service.

PIANO AND ORGAN SERVICEMEN

(D.O.T. 730.281, .381, and 829.381)

Nature of the Work

There are four kinds of piano and organ servicemen: piano tuners, piano technicians, pipe organ technicians, and electronic organ technicians. According to their skills, they tune, repair, and rebuild pianos and organs. They usually begin their trade by learning how to tune these keyboard instruments.

Piano tuners (D.O.T. 730.381) adjust piano strings so that they will be in proper pitch and sound musically correct. There are 220 strings in the modern 88-key piano. After muting the strings on either side, the tuner uses a tuning hammer (also called a tuning lever or wrench) to tighten or loosen the string being tested until its frequency matches that of a standard tuning fork. The other strings are tuned in relation to the starting string.

Sometimes the tuner has to make minor repairs, such as replacing worn or broken strings. Major repairs, however, are made by experienced craftsmen called piano technicians.

In addition to knowing how to tune a piano, *piano technicians*

(D.O.T. 730.281) can detect other problems that may affect its sound. Technicians talk with the customer to get an idea of what is wrong and then go to work to find out why. Once they find what the problem is they make the necessary repairs or adjustments. For example, they may have to realign hammers that do not strike the strings just right or replace moth-eaten felt on the hammers. To dismantle and repair pianos, technicians use common handtools as well as special ones such as regulating tools, repinning tools, and key leveling devices.

Although organs and pianos look somewhat alike, they function differently, and few servicemen work on both instruments. Moreover, organ servicemen specialize in either electronic or pipe organs.

Pipe-organ technicians (D.O.T. 730.381) install, tune, and repair organs that make music by forcing air through one of two kinds of pipes—flue pipes or reed pipes. The tone in a flue pipe, like in a penny whistle, is made by air forced by an opening. The reed pipe makes its tone by vibrating a brass reed in the air current.

Piano technician restrings baby grand.

Like a piano tuner, the organ technician uses his ear and a tuning fork to put an organ in good voice. To tune a flue pipe, the technician moves a metal slide which increases or decreases the pipe's "speaking length." A reed pipe is tuned by adjusting the length of the reed. A day or more may be needed to finish one of these jobs, because most organs have hundreds of pipes. Some workers specialize only in tuning, and do not have the all-round skills of a technician.

Most pipe organs are very large and complex, and are assembled on site in places like churches and auditoriums. Technicians install air chests, blowers, airducts, organ pipes, and other components. They follow the designer's blueprints and use a variety of hand and power tools to assemble components. Technicians may work in teams or be assisted by helpers. A job may take several weeks or even months, depending on the size of the organ.

Technicians may also maintain organs on a regular basis, returning every 3 or 4 months to tune them and make other routine adjustments.

Electronic organ technicians (D.O.T. 829.381) have very different duties from those of pipe organ technicians. They use special electronic test equipment to tune and to check tone and amplifications. Some electronic organs do not require tuning. Those that do are fairly simple to tune. However, these organs may break down due to loose connections, faulty transistors, dirty contacts, and other problems. When routine checks do not find the problem, technicians

use meters and electronic devices to check suspected circuits. For example, they check voltages until an unusual or irregular measure shows up the part of the circuitry causing trouble. When they find the problem, they make the necessary repairs or adjustments, using soldering irons, wire cutters, and other handtools. Technicians often use wiring diagrams and service manuals that show connections within organs, provide adjustment information, and describe causes of trouble. Because of the large differences among various brands of electronic organs, many technicians service only a particular brand.

Places of Employment

About 7,000 persons worked as full-time piano and organ servicemen in 1972; most were piano servicemen. A small percentage of these workers were women.

About two-thirds of the total worked in independent repair shops; many were the sole operators of small shops. Another one-fifth were employed by piano and organ dealers. Most of the rest worked for piano and organ manufacturers.

Piano and organ servicemen are employed mostly in big cities and in States that have large populations. In towns too small to offer enough work for a full-time serviceman, piano and pipe organ work may be done part time by local music teachers and professional musicians. Similarly, electronic organ work may be done by television and radio repairmen.

Training, Other Qualifications, and Advancement

Piano and organ servicemen generally learn on the job. Dealers and repair shops hire beginners to do general clean-up work, help servicemen move and install instruments, and do other routine tasks. Helpers gradually learn to tune and to make simple repairs, and then take on more difficult jobs as they gain experience. Generally, 3 to 4 years of on-the-job training are needed to qualify as a piano, pipe organ, or electronic organ technician, although workers who have formal education in these fields can qualify in less time. Piano tuning alone usually can be learned on the job in less than 2 years.

Piano and organ manufacturers train inexperienced workers to assemble instruments. However, because assembly is done in many steps, workers learn little about the instrument as a whole, and need additional training in tuning and repair work before they can qualify as technicians.

Young people interested in a career in piano or organ servicing should have good hearing, mechanical aptitude, and manual dexterity. Because service work frequently is done in the customer's home, a neat appearance and a pleasant, cooperative manner also are important. Although some very capable piano technicians are blind, organ technicians need normal eyesight. Ability to play the instrument helps, but is not essential as a qualification.

In terms of education, employers prefer high school graduates. Music courses help develop the student's ear for tonal quality. Courses in woodworking are useful also because many of the moving parts in pianos and pipe organs are made of wood. For jobs as electronic organ technician trainees, applicants usually need formal training in electronics available from technical schools, junior and community colleges, and some technical-vocational high schools. Training in electronics also is available in the Armed Forces.

Courses in piano technology, which may take up to 2 years, are offered by a small number of private technical schools. Some have special courses for the blind and other handicapped people. Home study (correspondence school) courses in piano and organ technology also are available.

Piano and organ servicemen keep up with new developments in their fields by studying trade magazines and manufacturers' service manuals. Most electronic organ manufacturers conduct brief courses periodically to provide information on technical changes in their instruments.

Servicemen who work for large dealers or repair shops can advance to supervisory positions. Most servicemen move up, however, by going into business for themselves. Relatively little capital is required beyond an initial investment in tools. Basic piano or pipe organ tools cost only a few hundred dollars. By contrast, tools and test equipment for electronic organs may cost a thousand dollars or more. Typically, self-employed servicemen operate out of their own homes and use a car or a small truck for service calls.

Employment Outlook

Little growth in the number of piano tuners, piano technicians, and pipe organ technicians is expected through the mid-1980's. The number of pianos and pipe organs has not increased much in recent years, primarily because of competition from other forms of entertainment and recreation, and this trend is expected to continue. Nevertheless, some jobs will open each year as experienced workers retire, die, or transfer to other occupations. Nearly all will be for piano tuners and technicians.

A moderate increase in jobs for electronic organ technicians is expected. The electronic organ, a comparatively new instrument, continues to grow in popularity. However, this is a very small occupation and the number of job openings will be far fewer than those for piano tuners and technicians.

Opportunities for beginners will be best in piano and organ dealerships and large repair shops. Many repair shops are too small to afford a full-time helper, although they may hire one part time.

Earnings and Working Conditions

Experienced workers earned from $3 to $8 an hour in 1972, depending on their level of skill and where they worked, according to limited information. Beginning rates for helpers ranged from $1.80 to $2.55 an hour.

Many self-employed servicemen earned more than $10,000 a year, and earnings in excess of $15,000 a year were not uncommon. Earnings of self-employed servicemen depend on the size of the community, their ability to attract and keep customers, their operating expenses, and competition from other servicemen.

Service business increases with cold weather because people spend more time indoors playing the piano or organ. Consequently, during fall and winter, many servicemen work more than 40 hours a week. As business falls off during spring and summer, shops may take up the slack by reconditioning or rebuilding old instruments. Self-employed servicemen frequently work evenings and weekends to suit their customers.

Many employers provide holidays and vacation pay. Some of the larger ones also provide life and health insurance, paid sick leave, and other benefits.

The work is relatively safe, although servicemen may suffer small cuts and bruises when making repairs. Electrical shock is a minor hazard for electronic organ technicians but it has rarely caused serious injury. Work is performed in shops and homes and public buildings such as churches and schools where working conditions usually are pleasant.

Sources of Additonal Information

Details about job opportunities may be available from local piano and organ dealers and repair shops. General information about piano technicians and a list of schools offering courses in piano technology may be obtained from:

Piano Technicians Guild, Inc., P.O. Box 1813, Seattle, Wash. 98111.

SHOE REPAIRMEN

(D.O.T. 365.381)

Nature of the Work

Shoe repairmen spend most of their time replacing worn heels and soles. Repairmen prepare shoes by removing the worn soles and old stitching, and roughing the bottom of the shoes on sanding wheels. They select new soles or cut them from pieces of leather; and then cement, nail, or sew the soles to the shoes. Finally, they trim the soles. To reheel shoes, repairmen pry off old heels, select replacement heels or cut them to shape, and cement and nail them into place. After the heels and soles have been replaced, repairmen stain and buff them to match the color of the shoes. Before completing the job, repairmen may replace insoles, restitch loose seams, and polish the shoes. Highly skilled repairmen may design, make, or repair orthopedic shoes according to doctors' prescriptions. Repairmen also may mend handbags, luggage, tents, and other items made of leather, rubber, or canvas.

In large shops, repair work often is divided into a number of specialized tasks. For example, some repairmen only remove and replace heels and soles; others only restitch torn seams.

Shoe repairmen use power-

Shoe repairman replacing zipper.

operated sole-stitchers and heel-nailing machines, and manually operated sewing machines. Among the handtools they use are hammers, awls, and nippers.

Self-employed shoe repairmen have managerial responsibilities in addition to their regular duties. They estimate repair costs, keep records, and supervise other repairmen.

Places of Employment

About 25,000 shoe repairmen were employed in 1972. About three-fourths of them own shoe repair shops, many of which are small, one man operations. Most of the remaining repairmen worked in large shoe repair shops. Some repairmen worked in department stores, variety stores, shoe stores, and drycleaning shops.

All cities and towns and many very small communities have shoe repair shops. Employment, however, is concentrated in large cities.

Training, Other Qualifications, and Advancement

Most shoe repairmen are hired as helpers and trained on the job. Helpers begin by assisting experienced repairmen with simple tasks, such as staining, brushing, and shining shoes; then they progress to more difficult tasks, such as replacing heels, as they gain experience. Helpers who have aptitude and initiative can become qualified shoe repairmen after 2 years of on-the-job training.

Some repairmen learn their trade at vocational schools. A small number enter the occupation through apprenticeship training programs.

Skilled shoe repairmen in large shops may become foremen or managers. Those who have the necessary funds can open their own shops.

Employment Outlook

Employment of shoe repairmen is expected to decline slowly through the mid-1980's. Nevertheless, hundreds of openings will arise each year because of the need to replace experienced repairmen who retire, die, or change occupations.

Although the sale of shoes will increase as the population grows, several factors are expected to limit the demand for repairmen. In recent years, the popularity of canvas footwear, loafers, sandals, and cushion-soled shoes has increased. Because of their construction, these types of shoes often cannot be repaired. Also, as personal income rises, many people buy new shoes rather than repair old ones.

Earnings and Working Conditions

Information from a limited number of employers and union contracts indicate that many shoe repairmen earned between $2.50 and $3.50 an hour in 1972. Inexperienced trainees generally earned between $1.85 and $2.10 an hour. Some highly skilled repairmen, including managers of shoe repair shops, earned more than $200 a week.

Shoe repairmen generally work 8 hours a day, 5 days a week. The workweek for the self-employed, however, is often longer, sometimes 10 hours a day, 6 days a week. Although shoe repair shops are busiest during the spring and fall, work is steady with no seasonal layoffs. Employees in large shops receive from 1 to 4 weeks' paid vacation each year, depending on the length of service, and usually at least 6 paid holidays.

Working conditions generally are good in large repair shops. Some small shops, however, may be crowded and noisy and have poor light or ventilation. Strong odors from leather goods, dyes, and stains may be present.

Shoe repair work is not strenuous, but it does require stamina, because repairmen must stand up much of the time.

Sources of Additional Information

Information about work opportunities can be obtained from the local office of the State employment service, as well as shoe repair shops in the community.

TELEVISION AND RADIO SERVICE TECHNICIANS

(D.O.T. 720.281)

Nature of the Work

Television and radio service technicians repair a growing number of electronic products, of which television sets and radios are by far the most numerous. They also repair stereo components, tape recorders, intercoms, and public address systems. Some service technicians specialize in repairing one kind of equipment—for example, television sets or car radios.

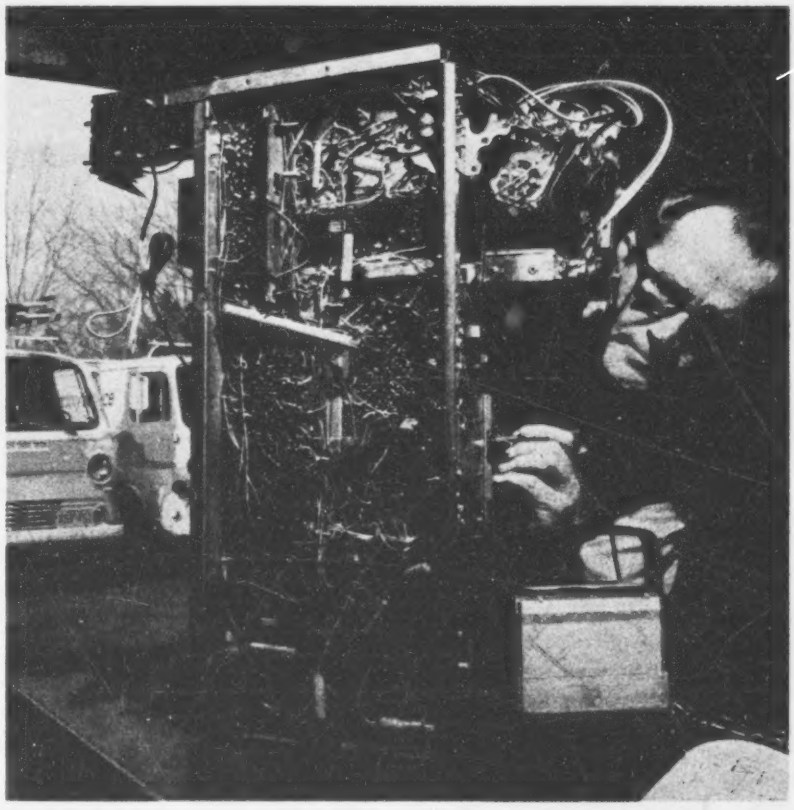
Equipment may operate unsatisfactorily or break down completely because of faulty tubes or transistors, poor connections, or other problems. Service technicians check and evaluate each possible cause of trouble; they begin by checking for the most common cause—tube or module failure. In other routine checks, they look for loose or broken connections and for parts that are charred or burned.

When routine checks do not locate the trouble, technicians use test equipment, such as voltmeters and signal generators, to check suspected circuits. For example, they

may measure voltages or wave forms in a television set until an unusual or irregular measurement indicates the faulty part. Once the cause of trouble is found, they replace faulty parts and make adjustments, such as focusing the picture or correcting the color balance.

Technicians who make customer service calls carry tubes, modules, and other parts that can be easily replaced in the customer's home. Radios, portable televisions, and other small equipment usually are repaired in service shops. Large television sets also are repaired in shops when the trouble must be located with complex test equipment.

Service technicians use screwdrivers, pliers, wire cutters, soldering irons, and other handtools. They refer to wiring diagrams and service manuals that show connections and provide information on how to locate problems and make repairs.



Television technicians use instruments to locate faulty circuits.

Places of Employment

More than 140,000 people worked as radio and television service technicians in 1972. About one-third of them were self-employed, a much larger proportion than in most skilled trades.

Nearly three-fourths of all service technicians worked in shops and stores that sell and service television sets, radios, and other electronic products. Many others were employed by manufacturers of such products.

Television and radio service technicians work in almost every city. Geographically, employment is distributed in much the same way as the Nation's population.

Training, Other Qualifications, and Advancement

Training in electronics is required in order to become a skilled television and radio service technician. Technical, vocational, or high school training in electronics, mathematics, and physics may provide a good background for entering the field. The military service offers training and work experience that is useful to civilian electronics work, and correspondence school courses also are helpful.

From 2 to 4 years of combined training and on-the-job experience are required to become a qualified service technician. People who have no previous training may be hired as helpers or apprentices if they show aptitude for the work or, like the amateur "ham" radio operator, have a hobby in electronics.

An important part of the service technician's training is provided by many manufacturers, employers, and trade associations. They conduct training programs to keep service technicians abreast of the latest servicing methods for new models or products. Technicians also keep up with technical developments by studying manufacturers' instruction books and technical magazines and by attending training meetings.

Programs to train unemployed and underemployed workers for entry jobs in television and radio servicing were in operation in several States in 1972 under the Manpower Development and Training Act and the JOBS (Job Opportunities in the Business Sector) Program. These programs usually last from about 6 months to a year.

Graduates, however, need additional training to become skilled technicians.

Television and radio service technicians must know how electronic components and circuits work. Other essential qualifications include the ability to manipulate small parts and tools, good eye-hand coordination, normal hearing, and good eyesight and color vision.

Service technicians who work in large repair shops may be promoted to foreman or service manager. Technicians who have sufficient funds may open their own sales and repair shops. Some technicians obtain jobs as electronic "trouble shooters" or technicians in manufacturing industries or government agencies. A small number of highly qualified technicians who are employed by manufacturers can advance to higher paying occupations, such as technical writer, sales engineer, design engineer, or service training instructor.

People interested in advancing to positions such as electronic technician can improve their opportunities by taking trade school, correspondence, or technical institute courses in automatic controls, electronic engineering, television engineering, and mathematics. Those planning to go into business for themselves should take some business administration courses, particularly accounting.

In 1972, several cities and six States—Indiana, Connecticut, Louisiana, Massachusetts, Florida, and Oregon—required that radio and television technicians be licensed. To obtain a license, applicants must pass an examination designed to test their knowledge of electronic circuits and components and their skill in the use of testing equipment.

Employment Outlook

Employment of television and radio service technicians is expected to increase moderately through the mid-1980's. In addition to openings from employment growth, many openings will result each year from the need to replace experienced technicians who retire, die, or change occupations.

Employment of service technicians is expected to increase in response to the growing number of radios, televisions, phonographs, tape recorders, and other home entertainment products in use. Factors that will contribute to this growth include rising population and personal incomes. In 1972, over 95 percent of all households had at least one television set. During the next decade, the number of households with two television sets or more is expected to increase significantly, mainly because of the growing demand for color and portable sets. Greater use of nonentertainment products, such as closed-circuit television, two-way radios, and various medical electronic devices, also is expected. For example, closed-circuit television is being used increasingly to monitor production processes in manufacturing plants and to bring educational programs into classrooms.

Earnings and Working Conditions

Earnings of television and radio service technicians ranged from $3 to $6.50 an hour in 1972, based on the limited information available. The wide variations in wage rates reflect differences in skill level, type of employer, and geographic location.

Television and radio service technicians employed in local service shops or dealer service departments usually work 40 to 48 hours a week. Some employers provide paid vacations and holidays; many also provide or help pay for health and life insurance benefits.

Service on television, radio, and other home entertainment products is performed in shops and homes where working conditions are usually pleasant. Some physical strain is involved in lifting and carrying equipment. Hazards include electrical shock and the risk of falling from roofs while installing or repairing antennas.

Some service technicians are members of labor unions. Most of them belong to the International Brotherhood of Electrical Workers.

Sources of Additional Information

For more information about jobs in this field, contact local shops and stores that service television sets and radios and other electronic equipment. Technical and vocational schools that offer courses in television and radio repair, or electronics may provide information about training. In addition, the local office of the State employment service may have information about the Manpower Development and Training Act and other programs that provide training opportunities.

Information about the work of television and radio service technicians also is available from:

National Alliance of Television and Electronic Service Associations, 5908 South Troy St., Chicago, Ill. 60629.

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

TRUCK MECHANICS AND BUS MECHANICS

(D.O.T. 620.281)

Nature of the Work

Mechanics are needed to keep

the Nation's commercial vehicles in good operating condition. Truck mechanics maintain and repair heavy trucks used for mining, construction, and intercity travel; and small trucks used for local hauling. Bus mechanics service both local and transcontinental buses. Although many parts of large trucks and buses are similar to automobile parts, truck and bus mechanics repair large engines, complex transmissions and differentials, air-brakes, and other components that are different from those in automobiles.

Mechanics employed by organizations that maintain their own vehicles may spend much time doing preventive maintenance to assure safe vehicle operation, prevent wear and damage to parts, and reduce costly breakdowns. During a maintenance check, mechanics inspect brake systems, steering mechanisms, wheel bearings, and other parts, and make needed repairs and adjustments.

In large shops, mechanics may specialize in one or two kinds of repair. For example, some mechanics specialize in major engine or transmission work. If an engine is to be rebuilt, the mechanic disassembles it, examines parts—such as valves or pistons—for wear, and replaces or repairs defective parts. Many mechanics specialize in diesel engines; that power large trucks and buses. Diesel and gasoline engines are similar, but have different fuel and ignition systems. A mechanic who has worked only on gasoline engines needs special training to qualify as a diesel mechanic. (See statement on diesel mechanics elsewhere in the *Handbook*.)

Truck and bus mechanics use common handtools such as screwdrivers and pliers; power and machine tools such as pneumatic wrenches and drills; and welding and flame cutting equipment. They also use testing equipment, such as dynamometers to locate malfunctions, and jacks and hoists to lift and move large parts.

Truck mechanic works on engine.

When doing heavy work, such as removing engines and transmissions, two mechanics may work as a team, or a mechanic may be assisted by an apprentice or helper. Mechanics generally work under the supervision of a shop foreman or service manager.

Places of Employment

A large proportion of the estimated 115,000 truck mechanics employed in 1972 worked for firms that own fleets of trucks. Fleet owners include trucking companies and businesses that haul their own products such as dairies and bakeries. Other employers include truck dealers, truck manufacturers, truck repair shops, firms that rent or lease trucks, and Federal, State, and local governments.

Most of the estimated 20,000 bus mechanics employed in 1972 worked for local transit companies and intercity buslines. Bus manufacturers employed a relatively small number of mechanics.

Truck and bus mechanics are employed in every section of the country, but most of them work in large towns and cities where trucking companies, buslines, and other fleet owners have large repair shops.

Training, Other Qualifications, and Advancement

Most truck or bus mechanics learn their skills on the job. Beginners usually do tasks such as cleaning, fueling, and lubrication. They may be required to drive vehicles in and out of the shop. As beginners gain experience and as vacancies become available, they usually are promoted to be mechanics' helpers. In some shops, young persons—especially those who have prior automobile repair experience—begin as mechanics' helpers.

Most helpers can make minor repairs after a few months' experience, and advance to increasingly difficult jobs as they prove their ability. Generally, 3 to 4 years of on-the-job experience is necessary to qualify as an all-round truck or bus mechanic. Additional training may be necessary for mechanics who wish to specialize in diesel engines.

Most training authorities recommend a formal 4-year apprenticeship as the best way to learn these trades. Typical apprenticeship programs for truck and bus mechanics consist of approximately 8,000 hours of shop training and at least 576 hours of classroom instruction. Frequently, these programs include training in both diesel and gasoline engine repair.

In 1972, unemployed and underemployed workers seeking entry jobs as truck mechanics were trained in a large number of cities under the Manpower Development and Training Act. This training, which

lasts up to a year, stresses basic maintenance and repair work, but additional on-the-job or apprenticeship training is needed before graduates can qualify as skilled mechanics.

For entry jobs, employers generally look for applicants who have mechanical aptitude, are at least 18 years of age, and in good physical condition. Completion of high school is an advantage in getting an entry mechanic job, because most employers believe it indicates that a young person can finish a job and has advancement potential.

When the mechanic's duties include driving trucks or buses on public roads, applicants may have to get a State chauffeur's license. If the employer is engaged in interstate transportation, applicants also may have to meet qualifications for drivers established by the U.S. Department of Transportation. These applicants must be at least 21 years of age, able bodied, and have good hearing, and 20/40 eyesight with or without glasses. They must read and speak English and have a good driving record, including 1 year's driving experience.

Young persons interested in becoming truck or bus mechanics can gain valuable experience by taking high school or vocational school courses in automobile repair. Science and mathematics are helpful since they better one's understanding of how trucks and buses operate. Courses in diesel repair provide valuable related training. Practical experience in automobile repair from working in a gasoline service station, training in the Armed Forces, and working on automobiles as a hobby also is valuable.

Most mechanics must buy their own handtools. Experienced mechanics often have several hundred dollars invested in tools.

Employers sometimes send experienced mechanics to special training classes conducted by truck, bus, diesel engine, and parts manufacturers. In these classes, mechanics learn to repair the latest equipment or receive special training in subjects such as diagnosing engine malfunctions.

A young person considering a career as truck or bus mechanic should have strength and manual dexterity to handle tools and equipment. Good mechanics read many service and repair manuals to keep abreast of engineering changes. Truck and bus mechanics usually work independently and can see the results of their work.

Experienced mechanics who have supervisory ability may advance to shop foremen or service managers. Truck mechanics who have sales ability sometimes become truck salesmen. Some mechanics open their own gasoline service stations or repair shops.

Employment Outlook

Employment of truck mechanics is expected to increase rapidly through the mid-1980's as a result of significant increases in the transportation of freight by trucks. More trucks will be needed for both local and intercity hauling due to increased industrial activity, continued decentralization of industry, and the continued movement of the population to the suburbs.

Several hundred job openings for bus mechanics are anticipated annually through the mid-1980's to replace workers who retire, die, or transfer to other occupations. Total employment, however, is not expected to change significantly because of offsetting factors affecting the demand for bus service. More buses will be needed for local travel due to increased emphasis on mass transit systems. Intercity bus travel, on the other hand, is expected to remain about the same.

Earnings and Working Conditions

According to a survey covering 88 metropolitan areas in 1972, mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles had average hourly earnings of $4.83, one-fourth more than the average for all nonsupervisory workers in private industry, except farming.

Apprentices' wage rates generally start at half of skilled workers' rates and are increased about every 6 months until a rate of 90 percent is reached during the last 6 months of the training period.

Most mechanics work between 40 and 48 hours per week. Because many truck and bus firms provide service around the clock, mechanics may work evenings, night shifts, and weekends, for which they usually receive a higher rate of pay. A large number of employers provide holidays and vacation pay; many pay part or all the cost of employee health and life insurance. Some employers furnish laundered uniforms.

Truck mechanics and bus mechanics are subject to the usual shop hazards such as cuts and bruises. If proper safety precautions are not followed, one risks injury when repairing heavy parts supported on jacks and hoists. Mechanics handle greasy and dirty parts and may have to stand or lie in awkward or cramped positions when repairing vehicles. Work areas usually are well lighted, heated, and ventilated, and many employers provide locker rooms and shower facilities. Although most work is done indoors, mechanics occasionally make repairs outdoors where breakdowns occur.

Many truck and bus mechanics are members of labor unions, including the International Association of

Machinists and Aerospace Workers; the Amalgamated Transit Union; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Transport Workers Union of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffers, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

More details about work opportunities for truck or bus mechanics may be obtained from local employers such as trucking companies, truck dealers, or bus lines; locals of unions previously mentioned; or the local office of the State employment service. The State employment service also may have information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. General information about the work of truck mechanics and apprenticeship training may be obtained from:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

VENDING MACHINE MECHANICS

(D.O.T. 639.381)

Nature of the Work

Vending machines have become a familiar part of the everyday lives of most people. In places of recreation, work, and education, vending machines provide everything from a piece of candy to a full-course meal.

Vending machine mechanics keep these machines in good working order. They also assemble and install machines, and in some cases, stock them with merchandise. Some mechanics work only in repair shops and some work only in the field, but many do both.

In preparing machines for installation, mechanics follow instructions supplied by the manufacturer. After the machine is put together and tested, the mechanic fills it with products or ingredients and gives it a test run. When working on complicated machines, such as beverage or food dispensers, mechanics check to see that the machines give proper quantities of ingredients and that refrigerating and heating units work properly. On gravity-operated machines, mechanics check springs, plungers, and merchandise delivery systems. They also test coin and change-making mechanisms. When installing a machine on location, mechanics make the necessary water and electrical connections and recheck the machines for proper operation.

Preventive maintenance—avoiding trouble before it starts—is another major part of the job. For example, the mechanic periodically cleans electrical contact points, lubricates mechanical parts, and adjusts machines to perform properly. When a machine breaks down, the mechanic must determine the cause of the trouble. He first inspects the machine for obvious problems, such as loose electrical wires, malfunctions of the coin mechanism, and leaks. If the problem cannot be readily located, the repairman may refer to troubleshooting manuals and wiring diagrams and use testing devices such as electrical circuit testers to find the defective parts. The mechanic then repairs or replaces the faulty parts, either on location or in the employer's service shop.

Mechanics use pipe cutters, soldering irons, wrenches, screwdrivers, hammers, and other handtools. In the shop, they also may use power tools, such as grinding wheels, saws and drills.

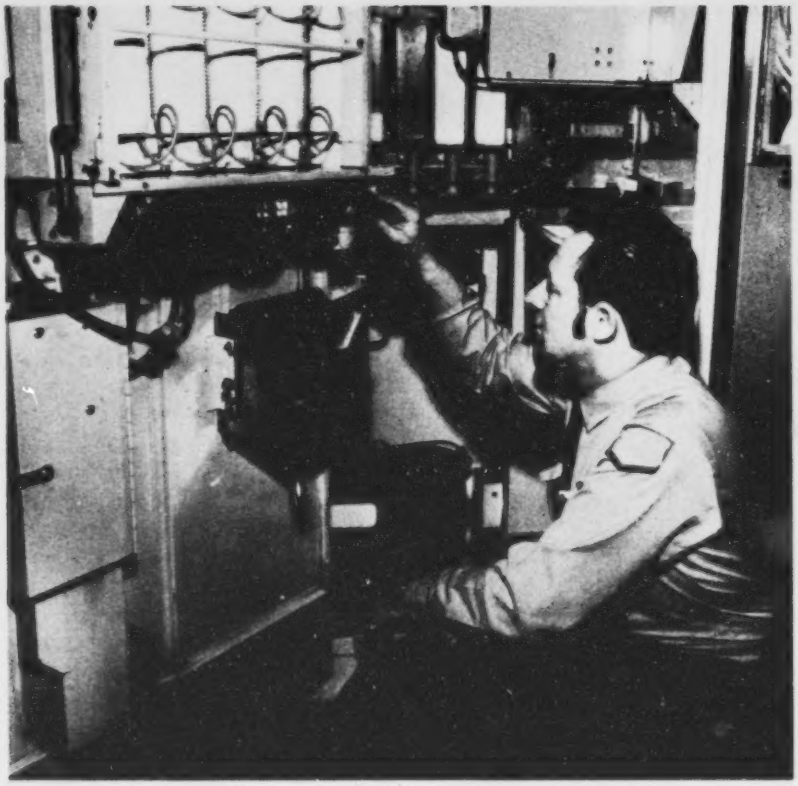
Mechanics who install and repair food vending machines must know State public health and sanitation standards as well as those established under local plumbing codes. They also must know and follow safety procedures, especially when lifting heavy objects and working with electricity and gas.

Mechanics have to do some clerical work, such as filing reports, preparing repair cost estimates, and ordering parts. Those employed by small operating companies frequently service as well as repair machines. These combination "repair-routemen" stock machines, collect money, fill coin and currency changers, and keep daily records of merchandise distributed. (Additional information about vending machine routemen is included in the statement on routemen elsewhere in the *Handbook*.)

Places of Employment

In 1972, about 29,000 mechanics maintained and repaired approximately 5 million vending machines. Most mechanics work for vending service companies that install machines and provide necessary services, such as cleaning, stocking, and repairing. Other mechanics work for beverage companies that have coin-operated machines. Some also work for companies that own and operate juke boxes, pin-ball machines, and laundry and dry cleaning machines. Although mechanics are employed throughout the country, most are located in industrial and commercial centers where there are a large number of vending machines.

Vending machine manufacturers



employ some highly skilled mechanics to explain technical innovations and ways to repair new machines to other repairmen. Instruction takes place either in manufacturers' service divisions in major cities or in operators' repair shops.

Training, Other Qualifications, and Advancement

Young people usually enter this trade as general shop helpers. If shop helpers show promise as mechanics, they may become trainees. Some workers are hired directly as trainees.

Trainees learn the trade on the job—observing, working with, and receiving instruction from experienced mechanics. Sometimes, they attend manufacturer-sponsored training sessions, which emphasize the repair of new and complex machines. Employers usually pay wages and expenses during these sessions which may last from a few days to several weeks.

Because vending machines are becoming more complex, some operators encourage both trainees and experienced mechanics to take evening courses in subjects related to machine operation and repair—for example, basic electricity. Employers pay for at least part of the tuition and book expenses for these courses.

The length of on-the-job training varies with the individual's capabilities and previous education. Although it usually takes from 1½ to 2 years for trainees to become skilled, they usually can handle simple repair jobs after 6 months. Mechanics are generally "in training" throughout their working lives, since they must be prepared to handle new and improved vending equipment.

Many beginners are high school graduates, but employers generally do not require a diploma. High school or vocational school courses in electricity, refrigeration, and machine repair help beginners to qualify for entry jobs. These courses also may help beginners to skip the lowest rung of the job ladder—general shop helper.

Employers require applicants to demonstrate mechanical ability, either through their work experience or by scoring well on mechanical aptitude tests. The ability to deal tactfully with people also is important. A commercial driver's license and a good driving record are essential for most vending machine repair jobs.

Skilled mechanics may be promoted to senior mechanic or, in large companies, to shop foremen or supervisor. Advancement to service manager, who schedules repair work, is possible for mechanics having administrative ability. Mechanics having initiative and adequate financial backing may become independent operators.

Employment Outlook

Employment of vending machine mechanics is expected to increase rapidly through the mid-1980's. In addition, many job openings will result from the need to replace workers who retire, die, or transfer to other fields of work.

Many factors will spur the demand for vending machines and, in turn, for the workers who service and repair them. The movement of industrial plants, schools, hospitals, department stores and other establishments to the suburbs where eating places are not always close by, will increase the demand for vending machines. Demand also may be stimulated by the rising popularity

of light meals, snacks, and quick lunches. Vending machines now offer a wide variety of merchandise with, in many cases, round-the-clock service and money-changing machines. This will make it more appealing and convenient for customers to use these machines.

Earnings and Working Conditions

Wage rates for vending machine mechanics ranged from $2.60 to $4.97 an hour in 1972, based on information from a small number of union contracts.

Most vending machine mechanics work 8 hours a day, 5 days a week, and receive premium pay for overtime. Since vending machines can be operated around the clock, mechanics frequently work at night and on weekends and holidays. Some union contracts stipulate higher pay for nightwork and for emergency repair jobs on weekends and holidays.

Many employers provide fringe benefits such as health and life insurance and retirement plans. Paid vacations are granted according to length of service—usually 1 week after 1 year of service, 2 weeks after 2 years, and 3 weeks after 10 years. Typically, mechanics also receive 7 or 8 paid holidays annually.

Vending machine repair shops are generally quiet, well-lighted, and have adequate work space. However, when servicing machines on location, mechanics may work in cramped quarters, such as passageways, where pedestrian traffic is heavy. Repair work is relatively safe, although mechanics are subject to shop hazards such as electrical shocks and cuts from sharp tools and metal objects.

Many vending machine mechanics employed by large companies are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America.

Sources of Additional Information

Further information on job opportunities can be obtained from local vending machine operators and local offices of the State employment service. Information is also available from the National Automatic Merchandising Association, 7 South Dearborn St., Chicago, Ill. 60603.

WATCH REPAIRMEN

(D.O.T. 715.281)

Nature of the Work

Watch repairmen (also called watchmakers) clean, repair, and adjust watches, clocks, and other timepieces. When a watch is not working properly, repairmen use tweezers, screwdrivers, and other tools to remove the watch from its case and disassemble the movement. With the aid of a special magnifying glass called a loupe, they carefully examine each part of the mechanism.

Repairmen may replace the mainspring and other parts of the winding mechanism, adjust improperly fitted wheels, and replace broken hands or a cracked watch crystal. They clean and oil parts before the watch is reassembled and tested for accuracy.

The development of interchangeable mass-produced watch parts has decreased the need to make parts by hand; however repairmen often must adjust factory-made parts of complicated timepieces to insure a true fit.

In addition to handtools, watch repairmen use timing and cleaning machines. They use electrical meters when repairing electric watches to make sure that circuits are working properly.

Watch repairmen often own jewelry stores, and may do minor jewelry repair and sell watches, jewelry, silverware and other items. They also may hire and supervise salesclerks, other watch repairmen, and jewelers; arrange window displays; purchase goods to be sold; and perform other managerial duties.

Places of Employment

About 16,000 watch repairmen were employed in 1972. Nearly half of them were self-employed. Most of the remainder worked in jewelry stores and repair shops or in factories that made watches, clocks, or other precision timing instruments. A few watch repairmen were instructors in vocational schools.

Although jewelry stores and repair shops are found in many small towns, most are in large commercial centers such as New York City, Chicago, Los Angeles, Philadelphia, and San Francisco. Nearly half of all manufacturing establishments are located in the mid-Atlantic region.

Training, Other Qualifications, and Advancement

Many young people become watch repairmen by taking courses in private watch repair schools or public vocational high schools. Others learn the trade through formal apprenticeship or on-the-job training programs.

There generally are no specific educational requirements for entrance into any of the approximately 40 watch repair schools although most students are high school graduates. Courses usually last 18

Watch repairmen need patience and good manual dexterity.

months, but the length of time varies with the ability of the individual student and whether attendance is full- or part-time. Students learn to take apart and reassemble various kinds of watch and clock movements, diagnose problems, make and adjust individual parts, and use and care for tools and machines. Some schools offer courses on repairing unusual types of timepieces, such as chronographs and timers. Most schools require students to furnish their own handtools.

The following States require watch repairmen to obtain a license: Florida, Indiana, Iowa, Kentucky, Louisiana, Michigan, Minnesota, North Carolina, North Dakota, Oregon, and Wisconsin. To obtain a license, repairmen must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair.

Watch repairmen in all States, however, can demonstrate their degree of competence by passing one or two certification examinations given by the American Watchmakers Institute. Successful examinees receive the title of either Certified Watchmaker or Certified Master Watchmaker, depending on their proficiency. Annual voluntary examinations covering new phases of watchmaking also are offered, and those who pass are given a plaque of recognition.

A young person planning a career as a watch repairman must be willing to sit for long periods and work with a minimum of supervision. The precise and delicate nature of the work requires patience and concentration. Good visual depth perception helps in working with tiny parts.

Beginners who have sufficient funds may open their own watch repair shops, but the usual practice is to work for an experienced watch repairman before starting one's own business. Watch repairmen may also open their own jewelry stores; however, these stores require a much greater financial investment than do repair shops.

Employment Outlook

Employment of watch repairmen is expected to show little or no change through the mid-1980's. However, hundreds of job openings will arise each year from the need to replace experienced workers who retire, die, or transfer to other occupations.

The number of watches and clocks in use will grow fairly rapidly due to rising population and incomes. The trends toward owning more than one watch, wearing watches as costume jewelry, and buying more children's watches are expected to continue. Only a limited number of these watches will be repaired, however, because most will be pin-lever types which cost little more to replace than to repair. Consequently, the demand for repairmen is not expected to keep pace with increases in the number of watches in use.

Earnings and Working Conditions

Earnings of watch repairmen in entry jobs generally ranged from about $125 to $150 a week in 1972, based on the limited information available. Experienced watch repairmen working in retail stores, repair shops, and watch manufacturing establishments received from $150 to $250 for a 40-hour week. In addition, repairmen in retail stores

may receive commissions based on sales of watches and other items in the store.

Watch repairmen who are in business for themselves usually earn considerably more than those working for a salary. Earnings of the self-employed depend on the amount of repair work done and, in the case of watch repairmen who own retail jewelry stores, the amount of sales.

Repairmen working in factories and large shops often are covered by life and health insurance programs and may participate in savings and investment plans.

Watch repairmen frequently work longer than the standard 40-hour week. Those who are self-employed or located in small communities often work a 48-hour week or longer. The work involves little physical exertion, however, and generally is performed in comfortable surroundings. This light benchwork frequently is recommended to certain handicapped workers.

Some watch repairmen are members of the International Jewelry Workers Union or the American Watch Workers Union (Ind.).

Sources of Additional Information

Information on training courses and watch repairing as a career can be obtained from:

American Watchmakers Institute, P.O. Box 11011, Cincinnati, Ohio 45211.

Information on job opportunities in retail stores can be obtained from:

Retail Jewelers of America, Inc., 1025 Vermont Ave. NW., Washington, D.C. 20005.

Further information about work opportunities or training in this trade also may be available from local offices of the State employment service.

HEALTH OCCUPATIONS

When people are sick or injured, the availability of health service becomes very important to them. These services depend not only on the number of people employed in health occupations, but also on their geographic distribution. Numbers employed have grown very rapidly in recent years. How to improve their distribution remains a problem which is being attacked on the national, State and local levels.

About 3.8 million people worked in health-related occupations in 1972. Besides doctors, nurses, dentists, and therapists, these include the behind-the-scenes technologists, technicians, administrators, and assitants.

Registered nurses, physicians, pharmacists, and dentists constitute the largest professional health occupations, and in 1972 ranged from 105,000 dentists to 750,000 registered nurses. Professional health occupations also include other medical practitioners (osteopathic physicians, chiropractors, optometrists, podiatrists, and veterinarians). Therapists (physical therapists, occupational therapists, and speech pathologists and audiologists) and administrators (hospital administrators and medical record administrators) also are professional health workers, as are dietitians and sanitarians.

Other health service workers include technicians of various types, such as medical technologist, medical X-ray technician, dental hygienist, and dental laboratory technician. Large numbers—1.3 million—worked as practical nurses and auxiliary workers, including nursing aides, orderlies, hospital attendants, and psychiatric assistants.

Hospitals employ about half of all workers in the health field. Others work in clinics, laboratories, pharmacies, nursing homes, public health agencies, mental health centers, private offices, and patients' homes. Health workers are employed mainly in the more heavily populated and prosperous areas of the Nation.

Large numbers of women work in health occupations. Almost all nurses are women, as well as most people in the technician, technologist and assistant occupations. Most people in the therapist and rehabilitation occupations also are women. While more than 9 of every 10 medical practitioners are men, an increasing number of women have entered these occupations in recent years.

Training

The educational and other requirements for work in the health field are as diverse as the health occupations themselves. For example, professional health workers—physicians, dentists, pharmacists, and others—must complete a number of years of preprofessional and professional college education and pass a State licensing examination. On the other hand, some health service occupations can be entered with little specialized training. Many community and junior colleges have introduced courses recently to prepare students for various health occupations. In most of the occupations for which on-the-job-training has been the usual means of preparation, employers now prefer persons who have completed one of these formal programs.

Earnings

Earnings of health workers range from the highest paid occupation—physicians—to that of hospital attendants, who receive three-fourths of the average earnings for nonsupervisory workers in private industry, except farming. Earnings for the other health occupations that can be entered with up to 2 years of formal training are about the same as average earnings for nonsupervisory workers in private industry, except farming. People in those health occupations that require graduation from college earn from one-and-a-half times to twice these average earnings. Among the occupations for which average yearly earnings are reported in the *Handbook*, the top 15 include 8 of the professional health occupations, including all 6 medical practitioners.

Outlook

Overall employment in the health field is expected to grow very rapidly through the mid-1980's, although the rates of growth will differ considerably among individual health occupations. Among the fac-

tors that are expected to contribute to an increase in the demand for health care are population growth coupled with increasing health consciousness and rising standards of living. Expansion of coverage under payment programs that make it easier for persons to pay for hospitalization and medical care also will cause growth in the health service occupations. Other openings will be created each year by the increasing expenditures by Federal, State, and local governments for health care and services.

In addition to jobs created by employment growth many new workers will be needed each year to replace those who retire, die, or—particularly for women—leave the field for other reasons.

Recent expansion of training programs in most of the occupations will add to the supply of trained health service personnel. The employment outlook in the various occupations ranges from excellent to possibly competitive, depending on the balance between supply of workers and expected openings. See the individual statements for an outlook description for each occupation.

DENTAL OCCUPATIONS

Proper dental care is an integral part of overall health care. This section focuses on the dental profession and the three key dental occupations.

Dentists examine and treat patients for oral diseases and abnormalities, such as decayed and impacted teeth. To an increasing extent, however, modern dentistry is emphasizing education in the proper care of teeth and gums to prevent future dental problems before they occur.

Dental hygienists are the only dental auxiliary required by each State to be licensed. They scale, clean, and polish teeth, expose X-rays, and instruct patients in proper oral hygiene.

Dental assistants assist dentists primarily in private offices. They prepare the patient for treatment and assist the dentist while he is working with the patient.

Dental laboratory technicians prepare various dental and orthodontal appliances from models and specifications received from dentists. This work requires patience, minute attention to detail, and a high degree of manual dexterity.

DENTISTS

(D.O.T. 072.108)

Dentists examine teeth and other tissues of the mouth to diagnose diseases or abnormalities. They take X-rays, fill cavities, straighten teeth, and treat gum diseases. Dentists extract teeth and substitute artificial dentures designed for the individual patient. They also perform corrective surgery of the gums and supporting bones. In addition, they may clean teeth.

Dentists spend most of their time with patients, but may devote some time to laboratory work such as making dentures and inlays. Many dentists, however—particularly in large cities—send most of their laboratory work to commercial firms. Some dentists also employ dental hygienists to clean patients' teeth and for other duties. (See statement on Dental Hygienists.) They also may employ other assistants who perform office work and assist in "chairside" duties.

Most dentists are general practitioners who provide many types of dental care; about 10 percent are specialists. The largest group of specialists are orthodontists, who straighten teeth. The next largest group, oral surgeons, operate in

the mouth and jaws. The remainder specialize in pedodontics (dentistry for children); periodontics (treating the gums); prosthodontics (making artificial teeth or dentures); endodontics (root canal therapy); public health dentistry; and oral pathology (diseases of the mouth).

About 3 percent of all dentists teach in dental schools, do research, or administer dental health programs on a full-time basis. Many dentists in private practice do this work on a part-time basis.

Places of Employment

About 105,000 dentists were at work in the United States in 1972—9 of every 10 were in private practice. About 5,800 served as commissioned officers in the Armed Forces, and about 1,400 had other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service. Women dentists represent only about 2 percent of the profession.

Training, Other Qualifications, and Advancement

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license, a candidate must be a graduate of an approved dental school and pass a State board examination. In 1972, 49 States and the District of Columbia recognized the examination given by the National Board of Dental Examiners as a substitute for the written part of the State board examinations. Delaware also requires new graduates to serve 1 year of hospital internship, in addition to passing the written examination. Most State licenses permit dentists to engage in both general and specialized practice. In 13 States, however, a dentist cannot be licensed as a "specialist" unless he has had 2 or 3 years of graduate education and passes a special State examination. Few States permit dentists licensed in other States to practice in their jurisdictions without further examination.

Dental colleges require from 2 to 3 years of predental education. However, of those students entering dental school in 1971, 70 percent had a baccalaureate or master's degree. Predental education must include courses in the sciences and humanities.

Competition is keen for admittance to dental schools. In selecting students, schools give considerable weight to college grades and amount of college education. In addition, all dental schools participate in a nationwide admission testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-supported dental schools also give preference to residents of their particular States.

Dental school training generally lasts 4 academic years although some institutions condense this into 3 calendar years. Studies begin with an emphasis on classroom instruction and laboratory work in basic sciences such as anatomy, microbiology, and physiology. The last 2 years are spent chiefly in a dental clinic, treating patients.

The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges. An equivalent degree, Doctor of Dental Medicine (D.M.D.) is conferred by 13 schools.

Dentists who want to do research, teach, or become specialists must spend an additional 2 to 4 years in advanced dental training in programs operated by dental schools, hospitals, and other institutions of higher education.

Dental education is very costly because of the length of time required to earn the dental degree. However, the Comprehensive Health Manpower Training Act of 1971 provides Federal funds for loans and scholarships of up to $3,500 a year to help needy students pursue full-time study leading to the degree.

The profession of dentistry requires both manual skills and a high level of intelligence. Dentists should have good visual memory, excellent judgment of space and shape, delicacy of touch, and a high degree of manual dexterity, as well as scientific ability. The ability to instill confidence, self-discipline, and a good business sense are helpful for success in private practice.

Most dental graduates open their own offices or purchase established practices. Some start in practice with established dentists, to gain experience and to save the money required to equip an office; others may enter residency or internship training programs in approved hospitals. Dentists who enter the Armed Forces are commissioned as captains in the Army and Air Force and as lieutenants in the Navy. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions (equivalent to lieutenants in the Navy) in the U.S. Public Health Service.

Employment Outlook

Employment opportunites for dentists are expected to be very good through the mid-1980's. Dental school enrollments have grown in recent years because of Federally-assisted construction of additional training facilities. However, unless schools expand beyond present

levels, the number of new entrants to the field is expected to fall short of the number needed to fill openings created by growth of the occupation and by those who die and retire from the profession.

Employment of dentists is expected to grow rapidly due to population growth, increased awareness that regular dental care helps prevent and control dental diseases, and the expansion of prepayment arrangements which make it easier for people to afford dental services. In addition, dental public health programs will need qualified administrators and dental colleges will need additional faculty members. Many dentists will continue to serve in the Armed Forces.

Improved dental hygiene and fluoridation of community water supplies may prevent some tooth and gum disorders, and preserve teeth that might otherwise be extracted. However, since the preserved teeth will need care in the future, these measures may increase rather than decrease the demand for dental care. New techniques, equipment, and drugs, as well as the expanded use of dental hygienists, assistants, and laboratory technicians should enable individual dentists to care for more patients. However, these developments are not expected to offset the need for more dentists.

Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to cover expenses, but their earnings usually rise rapidly as their practice develops. Specialists generally earn considerably more than general practitioners. The average income of dentists in 1972 was about $34,000 a year, according to limited information available. In the Federal Government, new graduates of dental schools could expect to start at $13,996 a year, in early 1973.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas, dental services are in great demand; however, a practice can be developed most quickly in small towns, where new dentists easily become known and they may face less competiton with established practitioners. Although the income from practice in small towns may rise rapidly at first, over the long run the level of earnings, like the cost of living, may be lower than it is in larger communities.

Most dental offices are open 5 days a week and some dentists have evening hours. Dentists usually work between 40 and 45 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, and a considerable number continue in part-time practice well beyond the usual retirement age.

Sources of Additional Information

Persons who wish to practice in a given State should get the requirements for licensure from the board of dental examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, is available from:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

American Association of Dental Schools 1625 Massachusetts Ave. NW., Washington, D.C. 20036.

Students should contact the Director of Student Financial Aid at the school they attend to get information about Federal loans and scholarships.

DENTAL ASSISTANTS

(D.O.T. 079.378)

Nature of the Work

Dental assistants work with dentists as they examine and treat patients. The assistant makes the patient comfortable in the dental chair, prepares him for treatment, and obtains his dental records. As the dentist works, the assistant hands him the proper instruments and materials and keeps the patient's mouth clear by using suction or other devices. Dental assistants may prepare materials for making impressions and restorations and may expose X-rays and process dental X-ray film as directed by the dentist. They also sterilize and care for dental instruments.

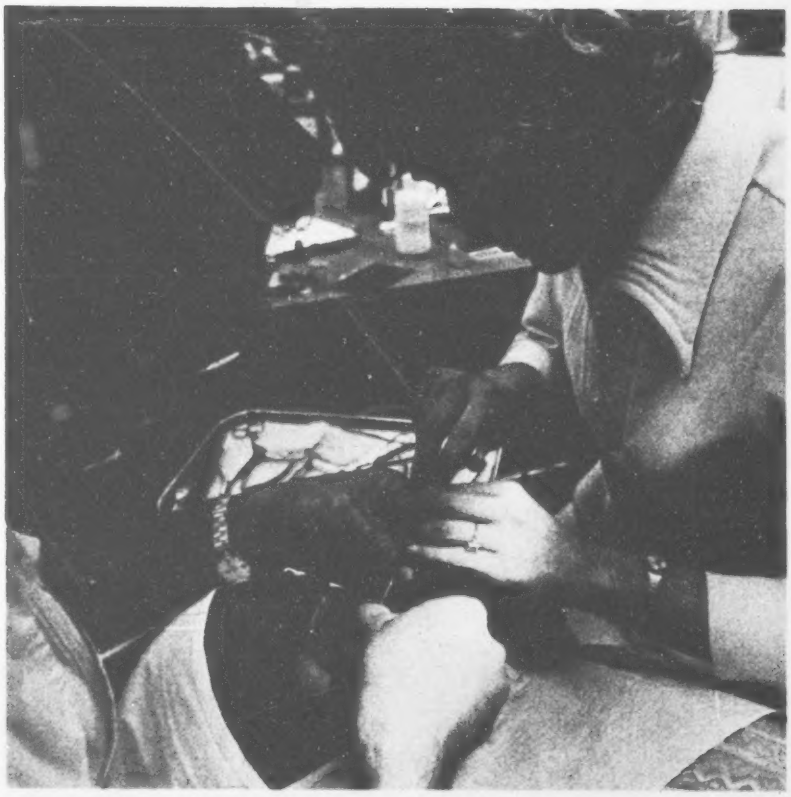
Dental assistants perform a variety of duties that do not require the dentist's professional knowledge and skill. Some assistants make casts of the teeth and mouth from impressions taken by the dentist. These casts are used by dentists and technicians to make dentures. Some dental assistants manage the office and arrange and confirm appointments, receive patients, keep treatment records, send bills, receive payments, and order dental supplies and materials.

The work of the dental assistant should not be confused with that of the dental hygienist who scales and cleans the teeth. (See statement on Dental Hygienists elsewhere in the *Handbook*.)

Places of Employment

Nearly 115,000 persons, practically all of them women, worked as dental assistants in 1972; about one out of five worked part time.

Most dental assistants work in private dental offices, either for individual dentists or for groups of



dentists. Many of the remainder work in dental schools, hospital dental departments, State and local public health departments, or private clinics. The Federal Government employs dental assistants, chiefly in the Public Health Service, the Veterans Administration, and the Department of the Army.

Training, Other Qualifications, and Advancement

Most dental assistants learn their skills on the job. An increasing number, however, are trained in formal post-high-school programs. About 200 such programs were accredited by the Council on Dental Education of the American Dental Association (ADA) in early 1973. Some were supported by funds authorized under Federal legislation, including the Vocational Education Act of 1963 and the Health Training Improvements Act of 1970.

Most post-high-school courses in dental assisting are given in junior and community colleges or in vocational or technical schools. More than three-fourths of these programs last one year and lead to a certificate or diploma. Graduates of 2-year programs offered in junior and community colleges earn an associate degree upon completion of specialized training and liberal arts courses. The minimum requirement for any of these programs is a high school diploma or its equivalent. Some schools also require typing or a science or business course. Although some private schools offer 4- to 6-month courses in dental assisting, these are not accredited by the dental profession.

Approved dental assisting curriculums include classroom and laboratory instruction in skills and related theory and usually a general occupational orientation. Trainees get practical experience in affiliated dental schools, local clinics or selected dental offices.

A correspondence course approved by the American Dental Association is available for employed dental assistants who are learning on the job or who otherwise are unable to participate in regular dental assisting programs on a full-time basis. The correspondence program is equivalent to 1 academic year of study, but generally requires about 2 years to complete.

Graduates of approved dental assistant programs who meet certain experience requirements and who successfully complete an examination administered by the Certifying Board of the American Dental Assistants Association may become Certified Dental Assistants. Certification is acknowledgement of an assistant's qualifications but is not generally required for employment.

After working 1 or 2 years, dental assistants sometimes seek to add to their skills by becoming dental hygienists. Prospective dental assistants who foresee this possibility should plan carefully since credit earned in a dental assistant program usually is not applicable toward requirements for a dental hygiene certificate.

Employment Outlook

Employment opportunities for dental assistants are expected to be excellent through the mid-1980's, especially for graduates of academic programs in dental assisting. Part-time opportunities also will be very favorable.

Employment of dental assistants is expected to grow rapidly, largely

because recent graduates of dental schools have been taught to use assistants in their practice. In addition, the increase in the demand for dental services which stems from population growth, a growing awareness of the importance of regular dental care, and the increasing ability of people to pay for care will contribute to the demand for dental assistants. For example, increased participation in dental prepayment plans and public programs such as Head Start and Medicaid bring dental services within the reach of many who could not otherwise afford them.

In addition to job openings created by growth in the demand for dental assistants, thousands of assistants also will be required each year to replace those who leave the field.

Earnings and Working Conditions

Salary depends largely on the assistant's education and experience, the duties and responsibilities attached to the particular job, and geographic location. Weekly salaries of assistants employed in private dental offices ranged from $80 to $160 in late 1972, according to the limited data available.

In the Federal Government, experience and the amount and type of education determine entrance salaries. In early 1973, a person who had 6 months of experience started at $6,128 a year; graduates of an ADA approved 1-year training program who had an additional year of general experience could expect to start at $6,882 a year.

Although the 40-hour workweek prevails for dental assistants, the schedule is likely to include work on Saturday. A 2- or 3-week paid vacation is common. Some dentists provide sick leave and other benefits. Dental assistants who work for the Federal Government receive the same employee benefits as other Federal workers.

Dental assistants work in a well-lighted, clean environment. They must be careful in handling X-ray and other equipment.

Sources of Additional Information

Information about career opportunities, scholarships, accredited dental assistant programs, including the correspondence program, and requirements for certification is available from:

American Dental Assistants Association, 211 East Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental assistants is available from:

Division of Dental health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20201.

DENTAL HYGIENISTS

(D.O.T. 078.368)

Nature of the Work

Dental hygienists remove deposits and stains from patients' teeth and apply prescribed medications to control dental decay. They take medical and dental histories; prepare diagnostic tests for interpretation by the dentist; and chart conditions of decay and disease for the dentists' use. They expose and develop dental X-ray films, sterilize instruments, and maintain patient records. They may mix filling compounds and act as chairside assistants to dentists. Hygienists also teach the techniques of mouth care and proper diet.

Dental hygienists who work in school systems examine children's teeth, assist dentists in determining the dental treatment needed, and report their findings to parents. They also clean teeth and give instruction on correct mouth care. Some help to develop classroom or assembly programs on oral health. Dental hygienists employed by health agencies work in dental clinics. A few assist in research projects. Those having advanced training may teach in schools of dental hygiene.

Places of Employment

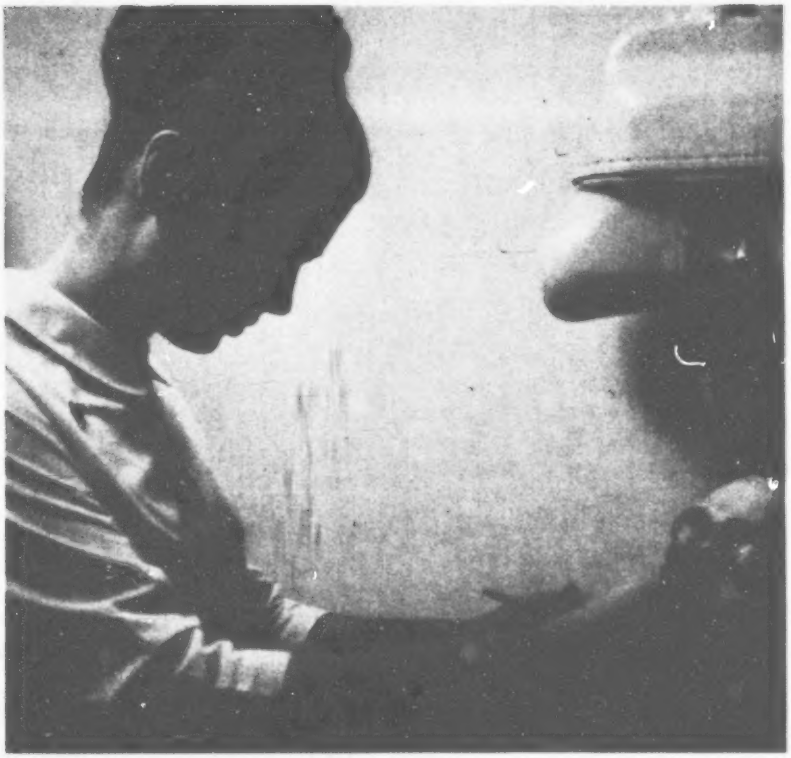
Nearly 17,000 persons, most of them women, worked as dental hygienists in 1972. Many work part time. Most work in private dental offices. Public health agencies, school systems, industrial plants, clinics, hospitals, dental hygiene schools and the Federal Government also employ dental hygienists. Some who are graduates of bachelor's degree programs are commissioned officers in the U.S. Army.

Training and Other Qualifications

Dental hygienists must be licensed. To get a license, a candidate must be a graduate of an accredited dental hygiene school, except in Alabama, and pass both a written and clinical examination. In 1972, candidates in 48 States and the District of Columbia could complete part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners.

In order to practice in a different State, a licensed dental hygienist must pass the State's examination. However, about 15 States grant licenses without further examination to dental hygienists already licensed in certain other States.

In 1972, about 150 schools of dental hygiene in the United States were accredited by the Council on Dental Education of the American Dental Association. Most of these schools provide a 2-year certificate or associate degree program. Some have 4-year programs leading to the bachelor's degree in dental hygiene



and others offer both programs. Five schools offer master's degree programs.

Completion of the 2-year program is sufficient for dental hygienists who want to practice in a private dental office. In order to do research, teach, and work in public or school health programs, the completion of a 4-year program usually is required.

The minimum requirement for admission to a school of dental hygiene is graduation from high school. Several schools which offer the bachelor's degree admit students to the dental hygiene program only after they have completed 2 years of college. Many schools also require that applicants take an aptitude test given by the American Dental Hygienist's Association.

The curriculum at a school of dental hygiene consists of courses in the basic sciences, dental sciences, and liberal arts. These schools offer laboratory work, clinical experience, and classroom instruction in subjects such as anatomy, chemistry, histology, pathology, pharmacology, and nutrition.

People who want to become dental hygienists should enjoy working with others. The ability to put patients at ease in an uncomfortable situation is helpful. Personal neatness and cleanliness, manual dexterity, and good health also are important qualities.

Employment Outlook

Employment opportunities for dental hygienists are expected to be very good through the mid-1980's. Despite an anticipated rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the number available for employment if current trends in enrollments continue.

Employment of dental hygienists is expected to rise very rapidly due to an expanding population and the growing awareness of the importance of regular dental care. Increased participation in dental prepayment plans and more group practice among dentists will result in new jobs for dental hygienists. Dental care programs for children also may lead to more employment opportunities in this field. In addition, a great number of job openings will be created by young women leaving their jobs for marriage and family responsibilities.

Mature women who wish to return to the field and those who desire part-time positions can expect to find very good opportunities for employment.

Earnings and Working Conditions

Earnings of dental hygienists are affected by the type of employer, education, and experience of the individual hygienists and the geographic location. Dental hygienists who work in private dental offices usually are salaried employees, although some are paid a commission for work performed or a combination of salary and commission.

Salaries of dental hygienists who work in dentists' offices averaged about $8,900 a year in 1972, according to the limited data available. This salary was about the same as the average for nonsupervisory workers in private industry, except farming. The beginning salary for a dental hygienist in the Federal Government ranged from $6,882 to $8,722 a year in early 1973, depending on education and geographic area.

Dental hygienists employed full time in private offices usually work between 35 and 40 hours a week. They may work on Saturdays or during evening hours. Some hygienists work for two or more dentists.

Dental hygienists work in clean, well-lighted offices. Important health protections for persons in this occupation are regular medical checkups and strict adherence to established procedures for using X-ray equipment and for disinfection.

Dental hygienists who work for school systems, health agencies, and the Federal or State governments have the same hours, vacation, sick leave, retirement, and health insurance benefits as other workers in these organizations.

Sources of Additional Information

For information about approved schools and the educational requirements needed to enter this occupation, contact:

Division of Educational Services, American Dental Hygienists Association, 211 East Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental hygienists is available from:

Division of Dental Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20201.

The State Board of Dental Examiners in each State, or the National Board of Dental Examiners, 211 East Chicago Ave., Chicago, Ill. 60611, can supply information on licensing requirements.

DENTAL LABORATORY TECHNICIANS

(D.O.T. 712.381)

Nature of the Work

Dental laboratory technicians make dentures (artificial teeth), crowns, bridges, and other dental and orthodontic appliances.

To make many dental appliances, the technicians form plaster models from written instructions and impressions of patients' mouths taken by dentists. They also make metal castings for dentures, finish and polish dentures, construct metal or porcelain crowns or inlays for partially destroyed teeth, make bridges of gold and other metals, and make appliances to correct abnormalities such as cleft palates.

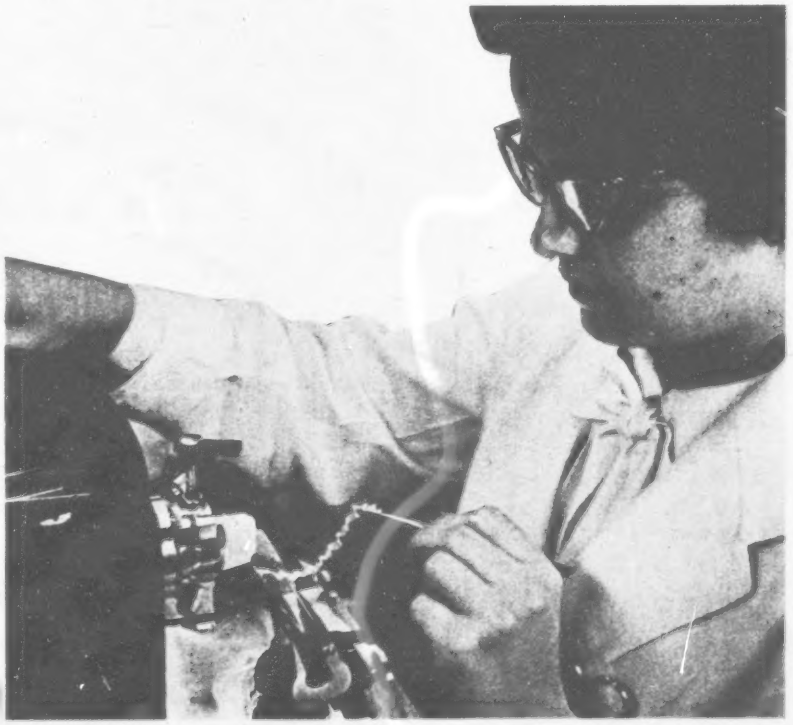
Trainees in beginning jobs usually mix and pour plaster into casts and molds and do other simple tasks. As they gain experience, they do more difficult laboratory work. Some dental laboratory technicians do all kinds of laboratory work. Others are specialists who make crowns and bridges, arrange artificial teeth on dental appliances, process plastic materials, work with dental ceramics (porcelain), or make castings of gold or other metal alloys. To perform their work, technicians use small handtools as well as special electric lathes and drills, high-heat furnaces, and other kinds of specialized laboratory equipment.

Places of Employment

About 32,000 persons worked as dental laboratory technicians in 1972; an estimated one-fifth of the working force were women. Most work in commercial laboratories, either as employees or as owners of the business. Commercial laboratories, which handle orders from dentists, usually employ fewer than 10 technicians. However, a few large laboratories employ over 200 technicians.

About 5,000 dental laboratory technicians work in dentists' offices. Others work for hospitals that provide dental services and for the Federal Government, chiefly in Veterans Administration hospitals and clinics and in the Armed Forces. Establishments that manufacture dental materials and equipment also employ dental laboratory technicians as technical representatives and salesmen.

Dental laboratories are located



mainly in large cities and populous States.

Training, Other Qualifications, and Advancement

Although no minimum formal education is needed to enter this occupation, a high school diploma is an asset. Most dental laboratory technicians learn their craft on the job. This training usually lasts 4 or 5 years, depending on the trainee's previous experience, his ability to master the techniques, and the number of specialized areas to be learned. A few public vocational high schools offer courses in dental laboratory work that may be taken in conjunction with on-the-job training.

In 1972, 2-year education programs accredited by the American Dental Association were offered in 33 schools. High school graduation or equivalent education is required to enter these programs. The first year of training includes formal classroom instruction in dental law and ethics, chemistry, ceramics, metallurgy, and other related subjects. During the second year, the student gets supervised practical experience in the school or dental laboratory. After completion of the 2-year training program, the trainee generally needs about 3 more years of practical experience to develop the skills needed in order to be recognized as a well-qualified dental technician.

Dental laboratory technicians may become Certified Dental Technicians after passing written and practical examinations given by the National Board for Certification, a trust established by the National Association of Dental Laboratories. Certification is becoming increasingly important as evidence of a technician's competence. Well-qualified technicians can advance to managers and foremen.

Among the personal qualifications that employers look for in selecting trainees are a high degree of manual dexterity, good color perception, patience, and a liking for detailed work. Preference also may be given to persons who have completed high school courses in art, crafts, or sciences.

Employment Outlook

Job opportunities for well-qualified dental laboratory technicians are expected to be very good through the mid-1980's. Some experienced technicians should be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospects of building a successful business.

Employment of dental laboratory technicians is expected to grow rapidly due to expansion of dental prepayment plans and the increasing number of older people who require artificial dentures. In addition, the number of dentists is not expected to keep pace with the demand for their services; to devote more time to treatment of patients, dentists will send more and more of their laboratory work to commercial firms, or hire dental laboratory technicians to work directly for them.

In addition to job opportunities created by growth, many openings for dental laboratory technicians will occur each year because of the need to replace technicians who transfer to other fields of work, retire, or die.

Earnings and Working Conditions

Dental laboratory technician trainees who worked in commercial laboratories earned an average of $80 a week in 1972. Technicians with 10 years' experience or more in commercial laboratories generally earned between $200 and $275 a week, depending on their skill and experience. This was higher than average earnings for nonsupervisory workers in private industry, except farming. Technicians who specialized in ceramics received the highest salaries. Large dental laboratories employ foremen or managers who generally earn more than technicians. In general, earnings of self-employed technicians are higher than those of salaried workers.

In the Federal Government, graduates of approved training programs were paid starting salaries of about $132 a week in early 1973. Experienced dental laboratory technicians employed in the Federal Government generally earned between $183 and $223 a week.

Salaried technicians usually work 40 hours a week but self-employed technicians frequently work longer hours. Many technicians in commercial laboratories receive paid holidays and vacations and some also receive paid sick leave, bonuses, and other fringe benefits. Technicians employed by the Federal Government have the same benefits as other Federal employees.

Sources of Additional Information

For information about the training and a list of approved schools contact:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

Information on scholarships is available from dental technology schools or from:

The American Fund for Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

For information on career opportunities in commercial laboratories and requirements for certification, contact:

National Association of Dental Laboratories, Inc., 3801 Mt. Vernon Ave., Alexandria, Va. 22305.

MEDICAL PRACTITIONERS

Medical practitioners work to prevent, cure, and alleviate disease. This group includes almost four times as many physicians as all other practitioners combined.

Physicians, osteopaths, and chiropractors treat diseases that affect the whole body; chiropractors and osteopaths emphasize manipulation of muscles and bones, especially the spine. Optometrists care for the eyes, and podiatrists treat foot diseases and deformities. Veterinarians care for animals.

All of these occupations are closely regulated States require that medical practitioners be licensed and pass a State board exam. Only physicians, osteopaths, podiatrists, and veterinarians can use drugs and surgery in their treatment.

Among the six medical practitioner occupations, educational requirements for a license vary from 6 to 9 years after high school. After graduation from college, osteopaths must complete a 4-year program and physicians generally 3 or 4 years. Most States require a 1-year internship for both physicians and osteopaths. Physicians who specialize must spend more years in residency and pass a specialty board examination. Most schools of chiropractic require that students complete 2 years of college preceding their 4-year program. Optometrists, podiatrists, and veterinarians all must complete a minimum of 2 years of college before beginning the 4-year program.

The percent of women medical practitioners varies. All occupations have fewer than 10 percent women, but this number represents a growth over the past few years. Student enrollments indicate that these percents will continue to grow.

All medical practitioners must have the ability and perseverance to complete the years of study required. Medical practitioners should be emotionally stable, able to make decisions in emergencies, and have a strong desire to help the sick and injured. Sincerity and the ability to relate to and gain the confidence of people also are important qualities for medical practitioners.

CHIROPRACTORS

(D.O.T. 079.108)

Nature of the Work

Chiropractic is a system of treatment based on the principle that a person's health is determined largely by the nervous system, and that interference with this system impairs normal functions and lowers resistance to disease. Chiropractors treat patients primarily by manual manipulation of parts of the body, especially the spinal column.

Because of the emphasis of the importance of the spine and its position, most chiropractors use X-rays extensively to aid in locating the source of patients' difficulties. Many also use such supplementary measures as water, light, and heat therapy, and prescribe diet, exercise, and rest. Most State laws restrict the type of supplementary treatment permitted in chiropractic. Chiropractic as a system for healing does not include the use of drugs or surgery.

Places of Employment

About 16,000 persons, 6 percent of them women, practiced chiropractic in 1972. Most chiropractors are in private practice. Some are salaried assistants of established practitioners or work for chiropractic clinics and industrial firms. Others teach or conduct research at chiropractic colleges. More than two-fifths of all chiropractors are located in California, New York, Texas, Missouri, and Ohio.

Training, Other Qualifications, and Advancement

Forty-eight States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. The type of practice permitted and the educational requirements for a license vary considerably from one State to another. In 1972, Louisiana and Mississippi did not regulate the practice of chiropractic or issue licenses.

Most States require successful completion of a 4-year chiropractic course following high school graduation. About three-quarters of the States also require 2 years of college work in addition to chiropractic training. Nearly two-fifths of the States also require that chiropractors pass a basic science examination. Chiropractors licensed in one State may obtain a license in another State by reciprocity.

In 1972, there were 10 chiropractic colleges. Most require 2 years of college before entrance, and some

require that specific courses be taken during these 2 years. Some chiropractic colleges emphasize courses in manipulation and spinal adjustments. Others offer a broader curriculum, including subjects such as physiotheraphy and nutrition. In most chiropractic colleges, the first 2 years of the curriculum are devoted chiefly to classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. During the last 2 years, students obtain practical experience in college clinics. The degree of Doctor of Chiropractic (D.C.) is awarded to students completing 4 years of chiropractic training.

Chiropractic requires considerable hand dexterity but not unusual strength or endurance. Persons desiring to become chiropractors should be able to work independently and handle responsibility. The ability to work with detail is important. Sympathy and understanding are among personal qualities considered desirable in dealing effectively with patients.

Most newly licensed chiropractors either set up a new practice or purchase an established one. Some start as salaried chiropractors to acquire experience and funds needed to establish their own practice. A moderate financial investment is usually necessary to open and equip an office.

Employment Outlook

Employment opportunities for chiropractors are expected to be favorable through the mid-1980's. Most of the openings will be to replace those who die and retire.

Underlying the expected moderate growth in the occupation are an increase in the population and the trend to include chiropractic services in health insurance coverage, including Medicare and Medicaid.

Since most States require some college training and others are likely to require it in the next few years, the outlook is best for those who have completed 2 years of college in addition to the 4 years of chiropractic college.

Opportunities for new graduates to begin their own practice are likely to be best in those parts of the country where chiropractic is generally accepted as a method of health care. Opportunities also should be good for those who wish to enter salaried positions in chiropractic clinics, chiropractic colleges, and other organizations that employ chiropractors.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low in the beginning, but rise after the first few years. Incomes of chiropractors vary widely. Earnings for beginning chiropractors average about $10,000 a year. Experienced chiropractors usually earn from $14,000 to $28,000 annually, with an average of about $24,000, according to limited data available.

Sources of Additional Information

The State board of licensing in the capital of each State can supply information on State licensing requirements.

General information on chiropractic as a career and a list of

schools of chiropractic are available from:

American Chiropractic Association, 2200 Grand Ave., Des Moines, Iowa 50312.

International Chiropractors Association 741 Brady St., Davenport, Iowa 52808.

For information on requirements for admission to a specific chiropractic college, contact the admissions office of that school.

OPTOMETRISTS

(D.O.T. 079.108)

Nature of the Work

About 2 out of every 5 persons in the United States need eye care. Optometrists provide most of this care. They examine people's eyes for vision problems, disease, and other abnormal conditions, and test for proper depth and color perception and the ability to focus and coordinate the eyes. When necessary, they prescribe lenses and treatment. Most optometrists supply the prescribed eyeglasses and fit and adjust contact lenses. Optometrists also prescribe corrective eye exercises or other treatment not requiring drugs or surgery.

Although most optometrists are in general practice, some specialize in work with the aged or with children. Others work only with persons having partial sight who can be helped with microscopic or telescopic lenses. Still others are concerned with the visual safety of industrial workers. A few optometrists teach or do research.

Optometrists should not be confused with either ophthalmologists, sometimes referred to as oculists, or with dispensing opticians. Ophthalmologists are physicians who specialize in eye diseases and injuries, perform eye surgery, and prescribe drugs or other eye treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statement on Dispensing Opticians.)

Places of Employment

In 1972, there were about 18,700 practicing optometrists; about 3 percent were women.

Most optometrists are in single practice. Others are in partnerships or group practice with other optometrists or doctors as part of a professional health care team.

Some optometrists work in specialized hospitals and eye clinics and teach in schools of optometry. Others work for the Veterans Administration, public and private health agencies, and industrial health insurance companies. About 600 optometrists serve as commissioned officers in the Armed Forces. Optometrists also may act as consultants to engineers specializing in safety or lighting, educators in remedial reading, or serve as members of health advisory committees to Federal, State and local governments.

According to a recent survey, about 3 optometrists out of 5 practice in towns of under 50,000 population.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require that optometrists

be licensed. Applicants for a license must have a Doctor of Optometry degree from an accredited optometric school and pass a State board examination. In some States, applicants are permitted to substitute the National Board of Optometry examination, given in the third and fourth year of optometric school, for the written State examination. Several States allow applicants to be licensed without lengthy examination if they have a license in another State.

The Doctor of Optometry degree requires a minimum of 6 years of college consisting of a 4 year professional degree program preceded by at least 2 years of preoptometric study at an accredited university, college, or junior college. In 1972, there were 12 optometric schools approved by the Council on Optometric Education of the American Optometric Association. Requirements for admission to these schools usually include courses in English, mathematics, physics, chemistry, and biology, or zoology. Some schools also require courses in psychology, social studies, literature, philosophy, and foreign languages.

Since most optometrists are self-employed, business ability, self-discipline, and the ability to deal with patients tactfully are necessary for success.

Most beginning optometrists enter into associate practice with an optometrist or other health professional. Others either purchase an established practice or set up a new practice. Some take salaried positions to obtain experience and the necessary funds to enter their own practice.

Optometrists wishing to advance in a specialized field may study for a Master's or Doctor of Philosophy degree in physiological optics, neurophysiology, public health administration, health information and communication, and health education. Optometrists who enter the Armed Forces as career officers have the opportunity to work toward advanced degrees and to do vision research.

Employment Outlook

Employment opportunities for optometrists are expected to be favorable through the mid-1980's. New graduates from schools of optometry are expected to be adequate to fill the positions made available by the moderate employment growth in the occupation and the need to replace optometrists who die and retire.

An increase in the total population, especially in the groups most likely to need glasses—older people and white-collar workers—is the main factor contributing to the moderate growth expected in the occupation. Greater recognition of the importance of good vision for efficiency at school and work, and the possibility that more persons will have health insurance to cover optometric services, also should increase the demand for optometric services.

Earnings and Working Conditions

In 1972, net earnings of new optometry graduates averaged about $13,000; experienced optometrists averaged from $26,000 to $28,000 annually. Incomes vary greatly, depending upon location, specialization, and other factors. Optometrists entering solo practice begin at approximately the same income level as those entering associateship or group practice. However, after several years, the optometrist in associateship or partnership practice will earn substantially more than his solo practitioner counterpart.

Independent practitioners can set their own work schedule. Some work over 40 hours a week, including Saturday. Since the work is not physically strenuous, optometrists often can continue to practice after the normal retirement age.

Sources of Additional Information

Information on optometry as a career and a list of scholarships and loan funds offered by various state associations, societies, and institutions are available from:

American Optometric Association
7000 Chippewa St., St. Louis, Mo. 63119.

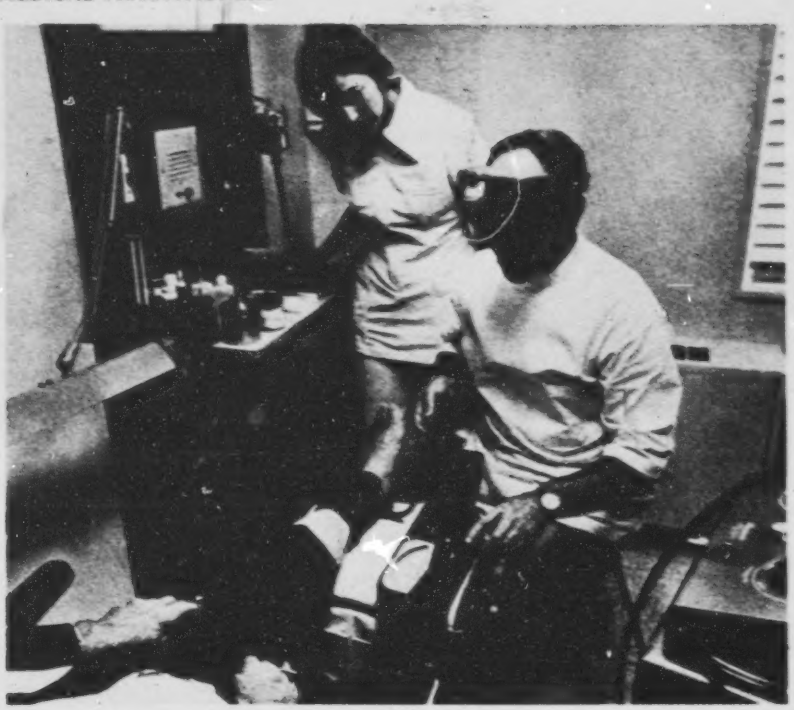
Federal Health Professions Scholarships and Loans are available for up to $3,500 per year for optometric students. For information on this financial aid and on required preoptometry courses contact individual optometry schools. The Board of Optometry in the capital of each State can supply a list of optometry schools approved by that State, as well as licensing requirements.

OSTEOPATHIC PHYSICIANS

(D.O.T. 071.108)

Nature of the Work

Osteopathic physicians diagnose, prescribe remedies, and treat diseases of the human body. They are particularly concerned about problems centered in the muscles or bones. The basic treatment or therapy used by osteopathic physicians centers on manipulating these systems with the hands. Osteopathic physicians also use



surgery, drugs, and all other accepted methods of medical care.

Most osteopathic physicians are "family doctors" who engage in general practice. These physicians usually see patients in their offices, make house calls, and treat patients in osteopathic and some city and county hospitals. A few doctors of osteopathy teach, do research, or write and edit scientific books and journals.

In recent years, specialization has increased. In 1972, about 10 percent were practicing specialties including internal medicine, neurology and psychiatry, ophthalmology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

Places of Employment

About 13,800 osteopathic physicians were practicing in the United States in 1972; nearly 9 percent were women. Nearly all osteopathic physicians were in private practice. Less than 5 percent had full-time salaried positions in osteopathic hospitals and colleges, private industry, or government agencies.

Osteopathic physicians are located chiefly in those States that have osteopathic hospital facilities. In 1972, almost half of all osteopathic physicians were in Michigan, Pennsylvania, Ohio, and Missouri. Twenty-three States and the District of Columbia each had fewer than 50 osteopathic physicians. More than half of all general practitioners are located in towns and cities having fewer than 50,000 people; specialists, however, practice mainly in large cities.

Training, Other Qualifications

A license to practice as an osteopathic physician is required in all States. To obtain a license, a candidate must be a graduate of an approved school of osteopathy and pass a State board examination. In 17 States and the District of Columbia, candidates must pass an examination in the basic sciences before they are eligible to take the professional examination; 36 States and the District of Columbia also require a period of internship in an approved hospital after graduation from an osteopathic school. The National Board of Osteopathic Examiners also gives an examination which is accepted by some states as a substitute for state examination. All States except Alaska and California grant licenses without further examination to properly qualified osteopathic physicians already licensed by another State.

Although 3 years of preosteopathic college work is the minimum entrance requirement for schools of osteopathy, almost all osteopathic students have a bachelors degree. Preosteopathic education must include courses in chemistry, physics, biology, and English. Osteopathic colleges require successful completion of 4 years of professional study for the degree of Doctor of Osteopathy (D.O.). During the first 2 years of professional training, emphasis is placed on basic sciences such as anatomy, physiology, pathology and on the principles of osteopathy; the last 2 years are devoted largely to work with patients in hospitals and clinics.

After graduation, nearly all doctors of osteopathy serve a 12-month internship at 1 of the 73 osteopathic hospitals that the American Osteopathic Association has approved for intern training. Those who wish to become specialists must have 2 to 5 years of additional training, followed by 2 years of supervised practice in the specialty.

The osteopathic physician's training is very costly because of the length of time it takes to earn the D.O. degree. However, Federal funds for loans and scholarships of up to $3,500 a year are available to help needy students pursue full-time study leading to the degree.

The seven schools of osteopathy admit students on the basis of grades received in college, scores on the required Medical College Admissions Test, and the amount of preosteopathic college work completed. The applicant's desire to serve as an osteopathic physician rather than as a doctor trained in other fields of medicine is a very important qualification. The colleges also give considerable weight to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathy usually establish their own practice, although a growing number are entering group practice. A few work as assistants to experienced physicians or become associated with osteopathic hospitals. In view of the variation in State laws, persons who wish to become osteopathic physicians should study carefully the professional and legal requirements of the State in which they plan to practice. The availability of osteopathic hospitals and clinical facilities also should be considered.

Persons who wish to become osteopathic physicians must have a strong desire to practice osteopathic principles of healing. They should have a keen sense of touch, emotional stability, and self-confidence. A pleasant personality, friendliness, patience, and the ability to deal with people also are important.

Employment Outlook

Opportunities for osteopathic physicians are expected to be very good through 1980. With the planned expansion of schools of osteopathy, by 1985 the number of osteopathic physicians available is expected to be in rough balance with the openings created by growth in the occupation and by those who die or retire from the profession. Greatest demand for their services probably will continue to be in States where osteopathy is a widely accepted method of treatment, such as Pennsylvania and a number of Midwestern States. Generally, prospects for beginning a successful practice are likely to be best in rural areas, small towns, and city suburbs, where the young doctor of osteopathy may establish his professional reputation more easily than in the centers of large cities.

The osteopathic profession is expected to grow very rapidly because of population growth; the extension of prepayment programs for hospitalization and medical care including Medicare and Medicaid; and the establishment of additional osteopathic hospital facilities.

Earnings and Working Conditions

In osteopathy, as in many of the other health professions, incomes usually rise markedly after the first few years of practice. Earnings of individual practitioners are determined mainly by ability, experience, geographic location, and the income level of the community served. In 1972, the average income of general practitioners after business expenses ranged from $25,000 to $35,000, according to limited data available. This income is very high in comparison with other professions. Specialists usually had higher incomes than general practitioners.

Many osteopathic physicians work more than 50 or 60 hours a week. Those in general practice work longer and more irregular hours than specialists.

Sources of Additional Information

People who wish to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. Information on Federal scholarships and loans is available from the Director of Student Financial Aid at the individual schools of osteopathy. For a list of State boards, as well as general information on osteopathy as a career, contact:

American Osteopathic Association
212 East Ohio St., Chicago, Ill. 60611.

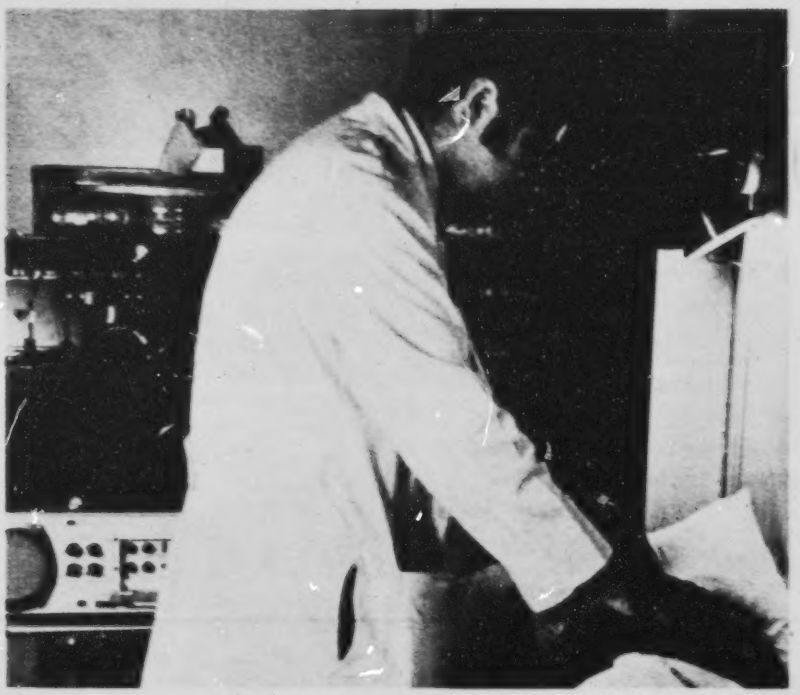
PHYSICIANS

(D.O.T. 070.101 and .108)

Nature of the Work

People in the United States visit a physician on the average of about 5 times a year either for treatment of an illness or injury or else for routine checkups. Physicians diagnose diseases and treat people who are suffering from injury or disease. They also try to prevent illness by advising patients on self-care related to diet and exercise. Physicians generally examine and treat patients in their own offices and in hospitals, but they may also visit patients at home.

About one-fifth of the physicians who provide patient care are general practitioners; the others specialize in 1 of the 33 fields recognized by the medical profession. The largest specialties are internal medicine, general surgery,



obstetrics and gynecology, psychiatry, pediatrics, radiology, anesthesiology, opthalmology, pathology, and orthopedic surgery.

Some physicians combine the practice of medicine with research or teaching in medical schools. Others hold full-time research or teaching positions or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

Places of Employment

About 316,500 physicians were professionally active in the U.S. in 1972; more than 7 percent were women. About 9 out of 10 provided patient care services. Nearly 196,000 of these physicians had office practices; more than 86,000 others worked as interns, residents, or full-time staff in hospitals. Over 36,000 taught or performed administrative or research duties.

In 1972, 17,500 graduates of foreign medical schools served as hospital interns and residents in this country. To be appointed to approved internships or residencies in U.S. hospitals, these graduates (citizens of foreign countries as well as U.S. citizens) must pass the American Medical Qualification Examination given by the Educational Council for Foreign Medical Graduates.

The Northeastern States have the highest ratio of physicians to population and the Southern States, the lowest. General practitioners are much more widely spread geographically than specialists, who tend to be concentrated in large cities.

Training and Other Qualifications

All States and the District of Columbia require a license to practice medicine. To qualify for a license, a candidate must be a graduate of an approved medical school, pass a licensing examination, and in 34 States and the District of Columbia serve a 1-year hospital internship. Eighteen States and the District of Columbia require candidates to pass a special examination in the basic sciences to become eligible for the licensing examination.

Licensing examinations are given by State boards. The National Board of Medical Examiners also gives an examination which is accepted by 48 States and the District of Columbia as a substitute for State examinations. Although physicians licensed in one State usually can get a license to practice in another without further examination, some States limit this reciprocity.

In 1972, there were 110 approved schools in the United States in which students could begin the study of medicine. One hundred seven award the degree of Doctor of Medicine (M.D.) to those who complete the course; 3 offer 2-year programs in the basic medical sciences to students who could then transfer to regular medical schools for the last semesters of study. Three new schools enrolled medical students for the first time during 1973.

Most medical schools require applicants to have completed at least 3 years of college education; some require 4 years. A few medical schools allow selected students who have exceptional qualifications to begin their professional study after 2 years of college. Most students who enter medical schools have a bachelor's degree.

Eleven States require various courses in premedical study such as undergraduate courses in English, physics, biology, and inorganic and

organic chemistry in an accredited college. Students should take courses in the humanities, mathematics, and the social sciences to acquire a broad general education. Other factors considered by medical schools in admitting students include the individual's college record and his scores on the Medical College Admission Test, which is taken by almost all applicants. Consideration also is given to the applicant's character, personality, and leadership qualities, as shown by personal interviews, letters of recommendation, and extracurricular activities in college. Many State-supported medical schools give preference to residents of their particular States and sometimes, those of nearby States.

The traditional curriculum leading to the M.D. degree is a 4-year course of study. However, more than 30 medical schools have shortened the curriculum or plan to do so. Most of these are 3-year curriculums, but a few schools offer the M.D. degree within 6 years of high school graduation.

The first semesters of medical school training are spent primarily in laboratories and classrooms, learning basic medical sciences such as anatomy, biochemistry, physiology, pharamacology, microbiology, and pathology. During the last semesters, students spend most of their time in hospitals and clinics under the supervision of experienced physicians. They learn to take case histories, perform examinations, and recognize diseases.

Many new physicians acquire training beyond the 1-year hospital internship. Those who plan to be general or family practitioners often spend an additional year or two as interns or residents in a hospital. To become certified specialists, physicians must pass specialty board examinations. To qualify for these examinations, they must spend from 2 to 4 years—depending on the specialty—in advanced hospital training as residents, followed by 2 years or more of practice in the specialty. Some doctors who want to teach or do research take graduate work leading to the master's or Ph.D. degree in a field such as biochemistry or microbiology.

Medical training is very costly because of the long time required to earn the medical degree. However, many private scholarships and loans are available for medical education. In addition, Federal funds provide scholarships and loans for up to $3,500 per year for students in the health professions who need financial aid.

Persons who wish to become physicians must have a strong desire to serve the sick and injured. They must be willing to study a great deal to keep up with the latest advances in medical science. Besides being one of the most exacting sciences, medicine demands that practitioners strictly adhere to high moral standards subscribed to by the profession, law and tradition. Sincerity and a pleasant personality are assets that help physicians gain the confidence of patients. Prospective physicians should be emotionally stable and able to make decisions in emergencies.

The majority of newly qualified physicians open their own offices or join associate or group practices. Those who have completed their internships and enter active military duty initially serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of medical schools are eligible for commissions as senior assistant surgeons (equivalent to lieutenants in the Navy) in the U.S. Public Health Service, as well as for Federal Civil Service professional medical positions.

Employment Outlook

The employment outlook for physicians is expected to be very good through 1985. Anticipated increases in graduates from existing and developing U.S. medical schools combined with foreign medical graduate entrants point to a greatly improved supply situation. This may result in an increasing movement of physicians into rural and other areas which have experienced shortage conditions in the past.

Foreign medical graduates are a large part of the new supply of physicians each year. In 1972, 1 new physician out of 3 was a foreign medical graduate. Even with the expansion of U.S. schools, by 1985 1 new physician out of 4 will still be a foreign medical graduate if their entry continues in line with past trends.

Even though the number of medical schools has increased in the last few years, the competition for first year places in medical school is becoming even greater. In 1973, there were about 40,000 applicants for 14,000 positions.

Growth in population will create much of the need for more physicians. Also, a larger percentage of the population will be in the age group over 65, which uses increased physicians' services. Also, the effective demand for physicians' care will increase because of greater ability to pay, resulting from extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid, and continued Federal Government provision of medical care for members of the Armed Forces, their families, and veterans. More physicians will be needed, in addition, for medical research and administration, and for teaching in medical schools, as well as the continuing growth in the fields of public health, rehabilitation, industrial medicine,

and mental health.

Recent concern over the distribution of physicians between specialties and general practice has resulted in creation of Federal funds for promotion of programs in family medicine. The new specialty of family practice has grown very rapidly since 1971, in keeping with the need for more M.D.'s who treat a variety of the more common illnesses.

To some extent, the rise in the demand for physicians' services will be offset by developments that will enable physicians to care for more patients. For example, increasing numbers of medical technicians are assisting physicians; new drugs and new medical techniques are shortening illnesses; and growing numbers of physicians are able to use their time more effectively by engaging in group practice. In addition, fewer house calls are being made by physicians because of the growing tendency to treat patients in hospitals and in physicians' offices.

The extent to which the developing health occupations, such as those of physicians' assistants and nurse practitioners, will enable each physician to treat more patients is as yet unknown. It is possible that these new health personnel will decrease the physicians' work significantly. In addition, legislation was passed in 1972 authorizing the Veterans Administration to assist States in the establishment of up to 8 new medical schools. As of mid-1973, no funds had been requested for the implementation of this legislation. However, if these schools were established, the increased number of physicians could create an oversupply in some geographic or specialty areas. Either a large increase in the number of physicians or the ability of each physician to treat more patients would force more physicians to establish their practice in sections of the country which have few doctors and to choose general practice or family medicine instead of one of the other specialties.

Earnings and Working Conditions

New graduates serving as interns in 1972 had an average annual salary of $8,838 in hospitals affiliated with medical schools and $10,076 in other hospitals. In 1972, residents earned average annual salaries of $7,572 in hospitals affiliated with medical schools and $9,418 in nonaffiliated hospitals, according to the American Medical Association. Many hospitals also provided full or partial room, board, and other maintenance allowances to their interns and residents.

Graduates employed by the Federal Government in 1973 received an annual starting salary of about $14,000 if they had completed their internship, and about $16,700 if they had completed a 1-year residency.

Newly qualified physicians who establish their own practice must make a sizable financial investment to equip a modern office. During the first year or two of independent practice, physicians probably earn little more than the minimum needed to pay expenses. As a rule, however, their earnings rise rapidly as their practice develops.

Physicians have the highest average annual earnings of any occupational group. The net income of physicians who provided patient care services averaged about $44,000 in 1972, according to limited information available. Earnings of physicians depend on factors such as the region of the country in which they practice; the patients' income levels; and the physician's skill, personality, and professional reputation, as well as the length of his experience. Self-employed physicians usually earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners. Many physicians have long working days and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may accept fewer new patients and tend to work fewer hours. However, many continue in practice well beyond 70 years of age.

Sources of Additional Information

Persons who wish to practice in a given State should find out about the requirements for licensure directly from the board of medical examiners of that State. Information on Federal scholarships and loans is available from the Director of Student Financial Aid at the individual medical schools. For a list of approved medical schools, as well as general information on premedical education, financial aid, and medicine as a career, contact:

Council on Medical Education, American Medical Association, 535 North Dearborn St., Chicago, Ill. 60610.

Association of American Medical Colleges, One Dupont Circle, NW., Washington, D.C. 20036.

PODIATRISTS

(D.O.T. 079.108)

Nature of the Work

Podiatrists diagnose and treat foot diseases and deformities. They perform surgery, fit corrective devices, and prescribe drugs, physical therapy, and proper shoes. To help in diagnoses, they take X-rays and perform or prescribe blood and other pathological tests. Among the con-

ditions podiatrists treat are corns, bunions, calluses, ingrown toenails, skin and nail diseases, deformed toes, and arch disabilities. They refer patients to medical doctors whenever the feet show symptoms of medical disorders affecting other parts of the body—such as arthritis, diabetes, or heart disease.

Some podiatrists specialize in foot surgery, orthopedics (bone, muscle, and joint disorders), podopediatrics (children's foot ailments), or podogeriatrics (foot problems of the elderly). However, most provide all types of foot care.

Places of Employment

About 7,300 persons practiced podiatry in 1972, 6 percent of them women. Most podiatrists practice in large cities. The few who had full-time salaried positions worked mainly in hospitals, podiatric colleges, or for other podiatrists. The Veterans Administration and city health departments employ podiatrists on either a full- or part-time basis. Others serve as commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license, an applicant must graduate from an accredited 4-year program in a college of podiatric medicine and pass a State board examination. Three States—Michigan, New Jersey, and Rhode Island—also require applicants to serve a 1-year internship in a hospital or clinic after graduation. Three-fourths of the States grant licenses without further examination to podiatrists licensed by another State.

The five colleges of podiatric medicine admit only students who have completed at least 2 years of college, including courses in English, chemistry, biology or zoology, physics, and mathematics.

The first 2 years in podiatry school include classroom instruction and laboratory work in basic sciences such as anatomy, bacteriology, chemistry, pathology, physiology, and pharmacology. During the final 2 years, students obtain clinical experience. The degree of Doctor of Podiatric Medicine (D.P.M.) is awarded upon graduation. Additional education and experience are generally necessary to practice in a specialty. Needy students may obtain loans and scholarships up to $3,500 a year from Federal funds provided by the Comprehensive Health Manpower Training Act of 1971.

Young people planning a career in podiatry should have a scientific aptitude, manual dexterity, and like detailed work. A good business sense, congeniality, and a sense of responsibility are additional assets in the profession.

Most newly licensed podiatrists set up their own practices. Some purchase established practices, or obtain salaried positions to gain the experience and money needed to begin their own practices.

Employment Outlook

Opportunities for graduates to establish new practices, as well as to enter salaried positions, should be favorable through the 1970's. Competition may increase in the 1980's, however, if the number of podiatry graduates increases as expected.

Through the mid-1980's, practice of podiatry is expected to grow moderately as a result of greater demand for health services by an expanding population, particularly the growing number of older people. This age group, the one needing the most foot care, is entitled to certain podiatrists' services under Medicare. Furthermore, the trend toward providing preventive foot care for children is increasing. More podiatrists will be needed to furnish services in hospitals, extended care facilities, and public health programs.

Earnings and Working Conditions

Experience and the income level and location of the community served have a great affect on earnings of individual podiatrists. Starting salaries of beginning podiatrists ranged from $12,000 to $16,000 in 1972, according to the limited available information. In podiatry, as in many other professions, incomes usually rise markedly after the first years of practice. Net income of podiatrists with five or less years of practice averaged about $21,000; with from 5/10 years' experience, $34,000.

The work week is generally 40 hours, and they may set their hours to suit their practice.

Sources of Additional Information

Information on license requirements in a particular State may be obtained from the State board of examiners in the State capital.

A list of colleges of podiatric medicine, entrance requirements, curriculums, and scholarships are available from:

American Association of Colleges of Podiatric Medicine, 20 Chevy Chase Circle, NW., Washington, D.C. 20015.

Additional information on podiatry as a career may be obtained from:

American Podiatry Association, 20 Chevy Chase Circle, NW., Washington, D.C. 20015.

VETERINARIANS

(D.O.T. 073.081 through .281)

Nature of the Work

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control diseases and injuries among animals. Their work is important for the Nation's food production. It is also important for public health, because it helps to prevent the outbreak and spread of animal diseases, many of which can be transmitted to human beings.

Veterinarians treat animals in hospitals and clinics or on the farm and ranch. They perform surgery on sick and injured animals and prescribe and administer drugs, medicines, and vaccines.

About two-fifths of all veterinarians treat small animals or pets. A large number specialize in the health and breeding of cattle, poultry, sheep, swine, or horses. Many veterinarians inspect meat, poultry, and other foods as part of Federal and State public health programs. Others teach in veterinary colleges. Some do research related to animal diseases, foods and drugs, or work as part of a medical research team to seek knowledge about prevention and treatment of human disease.

Places of Employment

About 26,000 veterinarians—3 percent of them women—were practicing in 1972. About three-fifths of all veterinarians were in private practice. The Federal Government employed more than 2,500 veterinarians, chiefly in the U.S. Department of Agriculture and the U.S. Public Health Service. About 900 more were commissioned officers in the veterinary corps of the Army and Air Force. Other employers of veterinarians are State and local government agencies, international health agencies, colleges of veterinary medicine, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies that manufacture drugs for animals.

Although veterinarians are located in all parts of the country, the type of practice generally varies according to geographic setting. Veterinarians in rural areas chiefly treat farm animals; those in small towns usually engage in general practice; those in cities and suburban areas often limit their practice to pets.

Training, Other Qualifications, and Advancement

Veterinarians must be licensed to practice in all States and the District of Columbia. To obtain a license, applicants must have a Doctor of Veterinary Medicine (D.V.M. or V.M.D.) degree and pass a State board examination. A few States also require that applicants have some practical experience under the supervision of a licensed veterinarian. Some States issue licenses without further examination to veterinarians already licensed by another State.

For positions in research and teaching, an additional master's or Ph.D. degree usually is required in a field such as pathology, physiology, or bacteriology.

Minimum requirements for the D.V.M. or V.M.D. degree are 2

years of preveterinary college work that emphasizes the physical and biological sciences, followed by 4 years of study in a college of veterinary medicine. However, two professional schools require 3 years of preveterinary study. Most veterinary school applicants have completed 3 to 4 years of college before entering the professional program. Veterinary college training includes considerable practical experience diagnosing and treating animal diseases and performing surgery, and laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

There were 18 colleges of veterinary medicine in the United States in 1972. When selecting students for admission, these colleges considered primarily the applicants' scholastic records and the amount and character of their preveterinary training. Residents of the State in which the college is located usually are given preference since veterinary colleges are largely State supported. In the South and West, regional educational plans permit cooperating States without veterinary schools to send a few students to designated regional schools. In other areas, colleges which accept a certain number of students from other States usually give priority to applicants from nearby States that do not have veterinary schools.

Needy students may obtain loans and scholarships of up to $3,500 a year to pursue full-time study leading to the degree of Doctor of Veterinary Medicine under provisions of the Comprehensive Health Manpower Training Act of 1971.

Most veterinarians begin as employees or partners in established practices. A few start their own practice with a modest financial investment in drugs, instruments, and an automobile. With a more substantial investment, one may open an animal hospital or purchase an established practice. Newly qualified veterinarians may enter the Army and Air Force as commissioned officers, or qualify for Federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, or research assistants.

Employment Outlook

Employment opportunities for veterinarians are expected to be favorable through the mid-1980's. The occupation is expected to grow very rapidly through the mid-1980's, primarily because of growth in the pet population, an increase in the numbers of livestock and poultry needed to feed an expanding population, and an increase in veterinary research. Emphasis on scientific methods of raising and breeding livestock and poultry and growth in public health and disease control programs also will contribute to the demand for veterinarians.

Earnings and Working Conditions

The incomes of veterinarians in private practice vary considerably, depending on such factors as location, type of practice, and years of experience. In 1972, the overall average income for veterinarians in private practice was $25,000.

Newly graduated veterinarians employed by the Federal Government started at $11,782 a year in early 1973. Salaries of experienced veterinarians employed by the Department of Agriculture ranged between $15,000 and $29,000 a year. The income of veterinarians in private practice usually is higher than that of other veterinarians, according to the limited data available.

Veterinarians sometimes may be exposed to danger of physical injury, disease and infection. Those in private practice often have long and irregular working hours. Veterinarians in rural areas may have to spend much time traveling to and from farms and may have to work outdoors in all kinds of weather. Veterinarians often can continue working well beyond normal retirement age because of many opportunities for part-time work.

Sources of Additional Information

A pamphlet entitled *Today's Veterinarian*, presents additional information on veterinary medicine as a career, as well as a list of colleges of veterinary medicine. A free copy may be obtained by submitting a request, together with a self-addressed stamped business size envelope, to:

American Veterinary Medical Association, 600 South Michigan Ave., Chicago, Ill. 60605.

Information on opportunities for veterinarians in the U.S. Department of Agriculture is available from:

Agricultural Research Service, U.S. Department of Agriculture, Hyattsville, Md. 20782.

Animal and Plant Health Inspection Service, Personnel Division, 12th and Independence Ave. SW., Washington, D.C. 20250.

Agricultural Marketing Service, Personnel Division, 12th and Independence Ave. SW., Washington, D.C. 20250.

Medical Technician, Technologist, and Assistant Occupations

This section deals in detail with nine health occupations that are technical or clerical in nature. Many of these occupations have evolved to relieve highly-trained professionals of the less-complicated and routine duties. *Medical assistants*, for example, in doctors' offices, assist with patient care as well as do clerical work. *Optometric assistants* give preliminary eye examinations and help patients do prescribed eye exercises. *Medical record technicians and clerks* process the large numbers of medical records generated daily in hospitals and nursing homes.

The development of sophisticated diagnostic tools and techniques for treatment, brought about by advances in medical science and technology, also has created the need for workers such as *electrocardiograph technicians* who operate equipment that monitors a patient's heart action, and *electroencephalograph technicians* who operate equipment that monitors the electrical activity of a patient's brain.

ELECTROCARDIOGRAPH TECHNICIANS

(D.O.T. 078.368)

Nature of the Work

Electrocardiograms (EKG's) are graphic heartbeat tracings produced by an instrument called an electrocardiograph. These tracings record the electrical changes that occur during a heartbeat. Physicians use electrocardiograms to diagnose irregularities in heart action and to analyze changes in the condition of a patient's heart over a period of time. Some physicians order electrocardiograms as a routine diagnostic procedure for persons who have reached a specified age. In some cases, the tests also are used if surgery is to be performed.

Electrocardiograph (EKG) technicians take and process electrocardiograms at the request of a physician. This can be done in a doctor's office, in the EKG department of a hospital, or at the patient's bedside, since the equipment is mobile. To perform an electrocardiogram, the technician straps electrodes to specified parts of the patient's body, manipulates selector switches of the electrocardiograph, and moves chest electrodes across the patient's chest. The test may be given while the patient is at rest, or before and after mild exercise.

The electrocardiograph records the "picture" of the patient's heart action on a continuous roll of paper. The technician then clips and mounts this electrocardiogram for analysis by a physician, usually a cardiologist or a heart specialist. During the test, technicians must be able to recognize and correct any technical errors or interferences recorded on the electrocardiograms. They also must be able to recognize any significant deviations from the norm that call for a doctor's attention.

EKG technicians sometimes conduct other tests such as basal metabolism tests, which measure energy usage, and phonocardiograms, which record the sounds of the heart valves and blood passing through them. In addition, technicians usually schedule appointments, type doctors' diagnoses, maintain patients' EKG files, and care for equipment.

Places of Employment

About 10,000 people worked as electrocardiograph technicians in 1972; most were women. Most EKG technicians worked in cardiology departments of large hospitals. Others worked part-time in small general hospitals where workloads are usually not great enough to demand full-time technicians. Some worked full- or part-time in clinics and doctors' offices.

Training, Other Qualifications, and Advancement

Generally, EKG technicians are trained on the job. Training—which may last as long as 3 months—usually is conducted by a senior EKG technician or a cardiologist. Generally, the minimum requirements for the job is high school graduation. Typing and familiarity

with medical terminology are helpful.

The military services also give some general training in electrocardiology. In addition, some manufacturers of electrocardiographs give instructions in the operation of their equipment.

Persons who want to become EKG technicians should have mechanical aptitude, the ability to follow detailed instructions, a calm presence of mind in emergency situations, common sense, reliability, and patience.

Larger hospitals sometimes promote EKG technicians to supervisors over other EKG technicians. Advancement to jobs as junior vascular-cardio technicians is also possible in some instances. Generally, however, opportunities for advancement are limited.

Employment Outlook

Employment opportunities for EKG technicians are expected to be very good through the mid-1980's. Employment is expected to rise very rapidly because of increasing reliance by physicians on electrocardiograms in the diagnosis of heart diseases and the routine use of EKG's by some physicians in physical examinations of patients above a certain age. Also contributing to the expected growth of this occupation is the increase in demand for health services in general, as a result of population growth, rising living standards, improved health consciousness, expanding medical services resulting from new medical techniques and drugs, and extension of prepayment programs that make it easier for people to pay for health and medical care.

In addition to openings resulting from growth in the occupation, workers will be needed to replace technicians who leave the field for marriage, family responsibilities, or other reasons.

Earnings and Working Conditions

EKG technicians who worked in hospitals and medical schools earned about $450 a month in 1972, according to a survey conducted by the University of Texas Medical Branch. Top salaries, in some cases, were as high as $830 a month.

Inexperienced EKG technicians starting work with the Federal Government earned $5,432 a year; a few experienced technicians earned as much as $10,007 a year.

EKG technicians who work in hospitals receive the same fringe benefits as other hospital personnel, including hospitalization, vacation, and sick leave. Some institutions provide tuition assistance or free education courses, pension programs, and uniforms. Technicians generally work a 40-hour week, which may include work on Saturdays.

Sources of Additional Information

Local hospitals can supply information about employment opportunities. For additional information about the work of EKG technicians contact:

American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

ELECTRO-ENCEPHALOGRAPHIC TECHNICIANS

(D.O.T.078.368)

Nature of the Work

EEG (electroencephalographic) technicians fulfill an important function in the diagnosis of brain disease and infections through electroencephalography—a system which records in graphic form the electrical activity of the brain.

Neurologists and other qualified professionals use EEG's to help diagnose such brain disorders as epilepsy and tumors, and assess damage and recovery after cerebral vascular strokes. Use of EEG's in pinpointing the time brain functions stop has also made them very important in vital organ transplant operations.

To carry out the procedure, the EEG technician measures the patient's head and attaches electrodes leading from the electroencephalograph to the patient's head. The complex machine detects and graphs (EEG's) the electrical activity of the patient's brain. Interpretation of the electroencephalograms is done by professional EEG personnel, often neurologists. However, the EEG technician must have some knowledge of medicine, anatomy, and physiology to understand the condition of the patient.

EEG technicians make routine repairs and replacements to keep equipment in good working order. They also schedule appointments and keep records of services performed for patients.

Places of Employment

About 3,500 persons—mostly women—worked as electroencephalograph technicians in 1972. Although EEG technicians work primarily in the neurology departments of hospitals, some work in neurologists' offices.

Training, Other Qualifications, and Advancement

Most EEG technicians working in 1972 were trained on the job by experienced EEG personnel. How-

ever, with advances in medical technology, electroencephalograph equipment becomes increasingly more sophisticated and requires technicians with more training.

About 10 programs in colleges and medical schools trained EEG technicians in early 1972. These programs lasted from 6 months to a year.

In recognition of the need for educational programs for EEG technicians, the Council on Medical Education of the American Medical Association, in collaboration with the American Electroencephalographic Society, the American Medical Electroencephalographic Association and the American Society of Electroencephalographic Technologists, developed a set of standards for use in the establishment of educational programs for EEG technicians and technologists. These standards recommend that programs last from 6 months to one year and include laboratory experience as well as classroom instruction in anatomy, physiology, neurophysiology, clinical and internal medicine, psychiatry, and electronics and instrumentation. Programs may be carried on in colleges, junior colleges, medical schools, hospitals, vocational or technical schools. In 1973, these standards were adopted by the American Medical Association's house of delegates.

EEG technicians who have one year of training and a year of experience, and successfully complete a written and oral examination administered by the American Board of Registration of Electroencephalograph Technologists (ABRET), may become registered (R.EEG.T.). Although not a general requirement for employment, registration by ABRET is acknowledgment of a technician's qualifications, and makes better-paying jobs easier to obtain.

People who want to enter this field should have manual dexterity, good vision, an aptitude for working with electronic equipment, and the ability to work with patients and with other members of the hospital team.

As openings occur, some EEG technicians in large hospitals advance to chief EEG technician and have increased responsibilities in laboratory management and in teaching basic techniques to new personnel. Chief EEG technicians are supervised by an electroencephalographer, or a neurologist or neurosurgeon.

Employment Outlook

Employment opportunities for EEG technicians are expected to be very good through the mid-1980's. The occupation is expected to grow rapidly because of increased use of EEG's in the diagnosis and monitoring of patients with brain disease and during surgical procedures. Factors contributing to the overall increase in health services, such as expanding population and rising living standards, also will stimulate the need for EEG technicians.

In addition to openings that will result from growth of the occupation, many will arise because of the need to replace the large number of workers who retire or leave the field for other reasons.

Earnings and Working Conditions

Starting salaries of EEG technicians employed by hospitals and medical centers averaged $507 a month in 1972, according to a survey conducted by the University of Texas Medical Branch. Top salaries of EEG technicians ranged as high as $830 a month. Very highly-qualified technicians may earn more in special training situations.

The annual beginning salary for inexperienced EEG trainees employed by the Federal Government was $5,432 in early 1973. Technicians in the Federal Government can earn as much as $10,007 a year.

EEG technicians in hospitals receive the same benefits as other hospital personnel, including hospitalization, vacation, and sick leave. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

EEG technicians generally work a 40-hour week with little after-hours or Saturday work involved.

Sources of Additional Information

Local hospitals can supply information about employment opportunities. Additional information about the work of EEG technicians is available from:

American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

For information on registration, contact:

American Board of Registration of Electroencephalographic Technologists, Cleveland Clinic, 9500 Euclid Ave., Cleveland, Ohio 44105.

MEDICAL ASSISTANTS

(D.O.T. 079.368)

Nature of the Work

Medical assistants help physicians examine and treat patients and take care of the clerical work necessary for a smoothly run office.

In helping physicians examine patients, medical assistants may check weight, height, temperature, and blood pressure, and make simple laboratory tests. In helping with treatment, they instruct patients about medication and self-treatment at home, give injections, apply bandages, and take electrocardiograms and X-rays. They also sterilize and clean instruments and supplies and perform routine tasks such as preparation of patients for examination, medical treatment, and minor surgery.

Medical assistants also do a variety of clerical jobs. They keep patients' medical records, fill out medical and insurance forms, handle correspondence, schedule appointments, answer the telephone, and greet patients. Among their other office duties they take dictation, keep the books, bill patients, and receive payments on bills.

Medical assistants also may arrange instruments and equipment in the examining room, check office and laboratory supplies, and maintain the waiting, consulting, and examination rooms in a neat and orderly condition.

Places of Employment

More than 200,000 people, most of them women, worked as medical assistants in 1972. Most work in the offices of physicians in private practice. The others work in hospitals and medical clinics.

Training, Other Qualifications, and Advancement

Most medical assistants receive their training on the job. However, a growing number are trained in vocational programs offered in some high schools, vocational institutes, and junior colleges. Other medical assistants learn their skills in adult education courses provided by post-secondary schools.

Applicants for on-the-job or post-secondary school training usually need a high school education or the equivalent. High school courses in mathematics, sciences, and office practices are helpful.

Most junior college programs last 2 years and lead to an associate degree; the others are 1 year programs, and graduates receive a diploma. Currently there are 22 2-year programs approved by the American Medical Association (AMA). The curriculum in these programs consists of courses in biology, chemistry, anatomy and physiology, typing, shorthand, and accounting. Students also get supervised, on-the-job clinical experience

and learn laboratory techniques, use of medical machines, administrative and clinical procedures, medical terminology, and office practices.

The American Association of Medical Assistants (AAMA) awards certificates to medical assistants who pass a written examination, have at least a high school education, and 3 years of experience in the field. Those with an associate degree need only one year of experience to be certified. Certification is not a license and is not required for AAMA membership; however, physicians usually consider Certified Medical Assistants (CMA's) to be well-qualified workers.

The American Medical Technologists registers medical assistants who pass a written examination and have completed a 9 to 12 month course from an accredited school. Currently over 20 schools are accredited by the Accrediting Bureau of Medical Laboratory Schools. The Registered Medical Assistant (RMA) like the CMA is recognized as competent in the field.

Persons who want to become medical assistants should get along well with people since they must work closely with a variety of persons. They also should be thorough, accurate, dependable, and conscientious.

Students who plan to continue their education and obtain a bachelor's degree should realize that not all 4-year colleges accept the same type and amount of junior college credits. Therefore, it is important to apply to a junior college that offers the kind of courses and number of credits acceptable for transfer to a four-year college.

Employment Outlook

Employment opportunities for medical assistants are expected to be excellent through the mid-1980's, particularly for graduates of two-year junior college programs.

Employment of medical assistants is expected to grow very rapidly because of the projected rapid increase in the number of physicians in patient care. The growing complexity of medical services, combined with the increasing volume of paper work, also will contribute to the demand for medical assistants.

The need for more medical assistants also is related to the demand for medical care services in general. Generating this demand is a growing population with an increasing proportion of older people who require more medical attention, and expansion in coverage under prepaid insurance programs, including Medicare and Medicaid, that enable more people to afford hospital and medical care.

In addition to openings resulting from growth of the occupation, many jobs will become available each year because of the need to replace workers who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

In 1972, weekly salaries generally ranged from $90 to $125 for inexperienced medical assistants, and from $125 to $160 for experienced assistants, according to limited information available. Salaries vary widely in different areas of the United States. The salaries of beginners depend on their training and other qualifications. Junior college graduates generally receive higher starting salaries than those paid workers without any training.

Medical assistants usually work a 40-hour week. Their hours, however, may be irregular. They may work evenings and on Saturdays. If so, they get equivalent time off during weekdays.

Sources of Additional Information

General information on a career as a medical assistant and on the certification program is available from:

American Association of Medical Assistants, One East Wacker Dr., Suite 1510 Chicago, Ill. 60601.

A list of accredited private schools and information on the registration program, is available from:

American Medical Technologists, 710 Higgins Rd., Park Ridge, Ill. 60068.

For information on training programs for medical assistants contact:

American Medical Association Council on Medical Education, 535 North Dearborn St., Chicago, Ill. 60610.

MEDICAL LABORATORY WORKERS

(D.O.T. 078.128, .168, .281, and .381)

Nature of the Work

Laboratory tests play an important part in the detection, diagnosis, and treatment of many diseases. Medical laboratory workers, often called clinical laboratory workers, include three levels: medical technologists, technicians, and assistants. They perform tests under the direction of pathologists (physicians who diagnose the causes and nature of disease), and other physicians, or scientists who specialize in clinical chemistry, microbiology, or the other biological sciences. Medical laboratory workers analyze the blood, tissues, and fluids in the human body by using precision

instruments, such as microscopes and automatic analyzers.

Medical technologists, who require 4 years of post-secondary training, perform complicated chemical, microscopic, and bacteriological tests. These tests may include chemical tests to determine, for example, blood cholestrol level, or microscopic examination of the blood to detect the presence of diseases such as leukemia. They microscopically examine other body fluids; make cultures of body fluid or tissue samples to determine the presence of bacteria, parasites, or other micro-organisms; and analyze them for chemical content or reaction. Technologists also may type and cross-match blood samples.

Technologists in small laboratories often perform many types of tests. Those in large laboratories usually specialize in areas such as microbiology, parasitology, biochemistry, blood banking, hematology (the study of blood cells), and nuclear medical technology (the use of radioactive isotopes to help detect diseases).

Most medical technologists conduct tests related to the examination and treatment of patients. However, some do research on new drugs or on the improvement of laboratory techniques. Others teach or perform administrative duties.

Medical laboratory technicians, who generally require 2 years of post-secondary training, perform a wide range of tests and laboratory procedures that require a high level of skill but not the technical knowledge of the highly-trained technologists. Like technologists, they may work in several areas or specialize in one field.

Medical laboratory assistants, who generally have a year or less of formal training, assist medical technologists in routine tests and related work that can be learned in a relatively short time. In large laboratories, they may concentrate in one of several areas. For example, they may identify slides with abnormal blood cells. In addition to performing routine tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Places of Employment

About 165,000 people worked as medical laboratory workers in 1972. About 80 percent of all medical laboratory workers were women; however, the number of men in the field has been increasing in recent years.

Most medical laboratory personnel work in hospitals. Others work in independent laboratories, physicians' offices, clinics, public health agencies, pharmaceutical firms, and research institutions. These places are concentrated in larger cities and populous States.

In 1972, Veterans Administration hospitals and laboratories employed about 1,600 medical technologists and about 1,900 medical laboratory technicians and assistants. Others worked for the Armed Forces and the U.S. Public Health Service.

Medical laboratory assistant prepares to scan blood smear to identify red and white blood cells.

Training, Other Qualifications, and Advancement

The minimum educational requirement for a beginning job as a medical technologist usually is 4 years of college training including completion of a specialized training program in medical technology.

Undergraduate work includes courses in chemistry, biological science, and mathematics. These studies give the technologist a broad understanding of the scientific principles underlying laboratory work. Specialized training usually requires 12 months of study and includes extensive laboratory work. In 1972, about 750 hospitals and schools offered programs approved by the American Medical Association. These programs were affiliated with colleges and universities and a bachelor's degree is usually awarded upon completion. A few schools require a bachelor's degree for entry into the program.

Many universities also offer advanced degrees in medical technology and related subjects for technologists who plan to specialize in laboratory work or in teaching, administration, or research.

Medical laboratory technicians employed in 1972 got their training in a variety of educational settings. Many attended junior or 4-year colleges and universities for one or more years. Others were trained in the Armed Forces. Some technicians received training in private and nonprofit vocational and technical schools.

Most medical laboratory assistants employed in 1972 were trained on the job. In recent years, however, an increasing number have

studied in one-year training programs conducted by hospitals, junior colleges in cooperation with hospitals, or vocational schools. Hospitals offer the greatest number of training programs. Applicants to these programs should be high school graduates with courses in science and mathematics. The programs include classroom instruction and practical training in the laboratory. They often begin with a general orientation to the clinical laboratory followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, and urinalysis.

Certification or registration is considered important in this field because it indicates that the persons certified have met educational standards recognized by the certifying body. After the successful completion of the appropriate examinations, medical technologists may be certified as Medical Technologists, MT (ASCP), by the board of Registry of the American Society of Clinical Pathologists; Medical Technologists, MT, by the American Medical Technologists; or Registered Medical Technologists, RMT, by the International Society of Clinical Laboratory Technologists. These organizations also certify technician-level workers. Laboratory assistants are certified by the American Society of Clinical Pathologists.

Medical technologists and/or technicians must be licensed in Alabama, California, Florida, Georgia, Hawaii, Illinois, Nevada, Pennsylvania, Tennessee, New York City, and Puerto Rico. Requirements for licensure include a written examination in some States.

Accuracy, dependability, and the ability to work under pressure are important personal characteristics for a medical laboratory worker. Manual dexterity and accurate color vision are highly desirable.

Young people interested in medical laboratory careers should use considerable care in selecting a training program. They should get information about the kinds of jobs obtained by graduates, educational costs, the accreditation of the school, the length of time the training program has been in operation, instructional facilities, and faculty qualifications.

Technologists may advance to supervisory positions in certain areas of laboratory work, or, after several years' experience, to chief medical technologist in a large hospital. Graduate education in one of the biological sciences or chemistry usually speeds advancement. Technicians can advance to technologists by getting necessary additional education and experience.

Employment Outlook

Employment of medical laboratory workers is expected to expand moderately through the mid-1980's, as physicians make wider use of laboratory tests in routine physical checkups and in the diagnosis and treatment of disease. Indirectly influencing growth in the field are population growth, rising standards of living, greater health consciousness, and expansion of prepayment programs for medical care that make it easier for people to pay for services.

While employment of laboratory personnel in general is expected to expand moderately, the use of automated laboratory test equipment may lead to a greater growth of medical laboratory technicians and assistants relative to technologists. Through technological advances, technicians and assistants can operate equipment to perform tests which previously required the skill of a technologist.

Technologists will be needed to fill supervisory positions in all laboratories. Also, some will be needed in laboratories where they are required by State licensing requirements or third party health insurance regulations, and in laboratories not using the new automated equipment.

In addition to medical laboratory workers who will be needed to fill openings resulting from expansion in the field, thousands of workers will be needed annually to replace those who die, retire, or leave their jobs for other reasons.

Earnings and Working Conditions

Salaries of medical laboratory workers vary by employer and geographic location. In general, medical laboratory workers employed on the West Coast and in large cities received the highest salaries.

Starting salaries for medical technologists in hospitals and medical schools averaged about $8,300 in 1972, according to a survey conducted by the University of Texas Medical Branch. Beginning salaries for laboratory assistants averaged about $6,200. Technicians earn salaries that range between those paid technologists and assistants.

The Federal Government paid newly graduated medical technologists with bachelor's degrees starting salaries of $7,694 a year in early 1973. Those having experience, superior academic achievement, or a year of graduate study entered at $9,520. The Federal Government paid medical laboratory assistants and technicians starting salaries ranging from $4,798 to $6,128 a year in early 1973, depending on the amount and type of education and experience.

Medical laboratory personnel gen-

erally work a 40-hour week. In hospitals, they can expect some night or weekend duty. Hospitals normally provide vacation and sick leave benefits; some have retirement plans.

Laboratories generally are well-lighted and clean. Although unpleasant odors and specimens of many kinds of diseased tissue often are present, few hazards exist if proper methods of sterilization and handling of specimens, materials, and equipment are used.

Sources of Additional Information

Information about education and training for medical technologists, technicians, and laboratory assistants meeting standards recognized by the medical profession and/or the U.S. Office of Education, as well as career information on these fields of work is available from:

Board of Registry of the American Society of Clinical Pathologists, Box 4872, Chicago, Ill. 60680.

American Society for Medical Technologists, 555 West Loop South, Houston, Tex. 77401.

The Accrediting Bureau of Medical Laboratory Schools of the American Medical Technologists, 710 Higgins Rd., Park Ridge, Ill. 60068.

For information about other technician training programs, contact:

International Society of Clinical Laboratory Technologists, 805 Ambassador Building, 411 North Seventh St., St. Louis, Mo. 63101.

Information about employment opportunities in government clinical and research hospitals is available from the Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20421, and the Clinical Center, National Institutes of Health, Bethesda, Maryland 20014.

MEDICAL RECORD TECHNICIANS AND CLERKS

(D.O.T. 249.388)

Nature of the Work

A medical record is a permanent report on a patient's condition and course of treatment in a hospital, clinic, or other health care institution. Doctors, hospital administrators, public health authorities, and insurance companies rely on these records which are kept by those behind-the-scenes but important members of the health care staff known as medical record technicians and clerks.

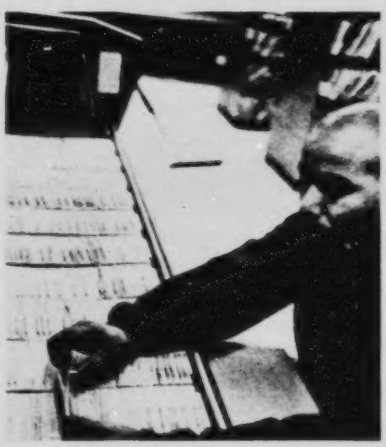
Medical record technicians and clerks compile, record, and file all of the medical reports that describe a patient's problem, diagnosis, treatment, and progress. This vital information is collected from many sources in the hospital or clinic, including the doctor and the X-ray, laboratory, dietary, and nursing departments.

The system used in hospitals to gather, preserve, and maintain the information for the medical records requires the teamwork of many medical record technicians and clerks. In large hospitals, record-keeping activities are supervised and coordinated by a medical record administrator, but in smaller hospitals, experienced medical record technicians often administer the department. In most nursing homes, a medical record clerk, working independently, is responsible for the limited number of medical records.

Medical record clerks perform routine clerical tasks that require a minimum of specialized knowledge. They assemble the information for the records in sequence; check to see that all necessary forms, signatures, and dates are present; and locate any previous medical records that may be on file for the patient. They translate selected information such as sex, age, and referral source into a code and enter it on the records. Medical record clerks answer routine staff requests for information about patients and gather statistics for reports to various groups such as State health departments. Some medical record clerks transcribe reports of operations, X-ray and laboratory examinations, and special treatments given to patients.

Medical record clerks follow the explicit instructions and guidelines of their supervisors. Person-to-person contacts in hospitals are limited to providing readily available, nontechnical information to the hospital staff. In small nursing homes where the medical record clerk works independently, however, there is much personal contact with the patients as well as with fellow staff members.

Beginning medical record technicians perform duties that may be similar to those of clerks but which require more technical knowledge. The technician codes the diseases, operations, and special therapies according to recognized classification systems and enters the codes on the medical record. This coding



makes it easier to refer to the record when there is a need to review the patient's case or to collect data for other purposes. Analyzing records and cross-indexing medical information make up a large part of the technician's work. Technicians do the important job of reviewing records for completeness, accuracy, and compliance with requirements, referring incomplete records to the person who compiled them. They review records for internal consistency and point out to their supervisors any apparent errors.

Technicians obtain information from records in answer to legal and insurance company inquiries when authorized to do so by hospital administrators, and gather statistics and prepare periodic reports for hospitals on types of diseases treated, types of surgery performed, and utilization of hospital beds. They also prepare records for microfilming, supervise medical record clerks, assist the medical staff by preparing special studies and tabulating data from records for research, and take records to court.

Places of Employment

In 1972, there were about 8,000 medical record technicians and 39,000 clerks. Although most work in hosptials, a growing number are finding jobs in clinics, nursing homes, community health centers, and health maintenance organizations. Some medical record technicians are consultants to several small health facilities. Some insurance companies employ experienced medical record personnel to collect information from patients' records to determine liability for payment. Public health departments hire medical record technicians to supervise data collection from health care institutions, and to assist in research to improve health care. Manufacturers of medical record systems, services, and equipment also employ medical record personnel to help develop and market their products.

Most medical record technicians and clerks are women. However, a growing number of men are entering the field.

Training, Other Qualifications, and Advancement

Most employers prefer to fill technician positions with graduates from one of the college or hospital-based programs which have been accredited by the American Medical Association and the American Medical Record Association. These range in length from 10-month certificate programs to 2-year associate degree programs. In 1972, there were approximately 50 such programs available. Required courses included biological sciences, medical terminology, medical record science, business management, and secretarial skills. Persons with this training who also have passed the Accredited Record Technician (ART) examination can enter the medical record field as technicians, and can often look forward to promotion to supervisory positions.

High school graduates who have basic secretarial skills can enter the medical record field as beginning clerks. About one month of on-the-job training will prepare them for routine tasks that do not require significant specialized skill. More training may be necessary for specialized clerical positions such as medical transcriptionists. Although they are not required, high school courses in Latin, biology, chemistry, and business subjects are helpful. Medical record personnel must be accurate and pay attention to detail.

The American Medical Record Association offers a correspondence course in medical transcription that can be taken either as a home study program or as in-service training. The certificate given upon the successful completion of the course is helpful in applying for a job as a medical record clerk. Medical terms and references learned provide a good foundation for advancement.

Medical record clerks who have had several years of experience may advance to the technician level, especially in areas where there is a shortage of trained medical record technicians. In addition, another AMRA correspondence course is available for medical record clerks to prepare for the examination for accreditation as medical record technicians. Passing this examination and earning the title of ART often leads to promotion to higher-paying and more responsible positions in medical records. In 1972, there were 5,440 ART's.

Employment Outlook

Employment of medical record technicians and clerks is expected to grow very rapidly through the mid-1980's. This employment growth will stem from an expected continued increase in the use of health insurance, Medicare and Medicaid, and rising medical care standards, with an accompanying need for more complete medical records. New jobs also will be created as nursing homes, clinics, and new types of medical facilities such as health maintenance organizations increasingly employ medical record personnel.

The duties performed by medical record clerks make up most of the work in a medical record department. Thus, the anticipated expansion in medical facilities and recordkeeping offers a very good

employment outlook for clerks. However, opportunities for advancement to the technician position without formal courses will greatly decrease.

The outlook for technicians with a 2-year course will be favorable through the mid-1980's. It is expected that medical record technicians will be required to have this specialized training in the future as more attention is given to innovative ideas in medical records as a means of improving medical efficiency and service. As a result, technicians who have not received formal training may experience strong competition for positions from medical record technicians who have an associate degree.

Earnings and Working Conditions

Earnings of medical record clerks and technicians vary greatly according to locality, but usually are higher than the salaries of general officeworkers. Beginning medical record clerks earned an average of $5,200 annually in nongovernment hospitals in 1972. Earnings ranged from $4,600 in small hospitals in the South to $8,800 in New York City, according to limited data. In general, salaries are highest in the big cities and lowest in rural areas. Salaries usually are higher in larger hospitals.

Salaries of medical record technicians follow a similar geographic pattern, but typical beginning salaries are about 30 percent higher than those of clerks. Limited data indicates that in 1972, the median annual salary for ART's was $7,100. Experienced technicians who were directors of hospital medical record departments averaged $7,850. Some earned over $10,000 a year.

In Federal hospitals, medical record clerks earned a beginning annual salary of $5,828 in 1972. Annual salaries of medical record technicians ranged from $6,554 to $11,711. Outstanding medical record technicians may work up to higher supervisory positions with corresponding pay increases, although most of these positions are filled by Registered Record Administrators.

Like most hospital employees, medical record personnel work a 40-hour week, receive paid holidays and vacations, health and insurance benefits, and can participate in retirement plans. Although most of the positions are full-time, some part-time jobs are available.

Sources of Additional Information

A list of approved schools for medical record technicians, facts about the correspondence courses for medical transcription and medical record personnel, and additional details on the work performed by medical record technicians can be obtained from:

American Medical Record Association
John Hancock Center, Suite 1850, 875 North Michigan Ave., Chicago, Ill. 60611.

OPERATING ROOM TECHNICIANS

(D.O.T. 079.378)

Nature of the Work

Operating room technicians, also known as surgical technicians, assist surgeons and anesthesiologists before, during, and after surgery. They are supervised by registered nurses.

They help set up the operating room with the instruments, equipment, sterile linens, and fluids such as blood and glucose that may be needed during an operation. Operating room technicians also prepare patients for surgery by washing, shaving, and disinfecting the parts of the body where the surgeon will operate. They may transport patients to the operating room and help drape and position them on the operating table.

During surgery, they pass instruments and other sterile supplies to members of the professional surgical team. They hold retractors, cut sutures, and help nurses count the sponges, needles, and instruments used during the operation. Operating room technicians help prepare, care for, and dispose of specimens taken for testing during the operation and help apply dressings. They may operate sterilizers, lights, suction machines, and diagnostic equipment.

After the operation, operating room technicians help transfer patients to the recovery room and assist nurses in cleaning and stocking the operating room for the next operation.

Places of Employment

More than 25,000 people, about one-half of them women, worked as operating room technicians in 1972. They worked in hospitals or other institutions that have operating room, delivery room and emergency room facilities. Many are members of the Armed Forces.

Training and Other Qualifications

Most operating room technicians are trained on the job. A high school education or the equivalent is generally required for employment. On-the-job training programs in many hospitals include classroom instruction. The length of these programs vary from six weeks

to one year, depending on the trainee's qualifications and the training given. Some hospitals prefer applicants who have worked as nurse aides or practical nurses.

Some operating room technicians are trained in adult, vocational, and technical schools, and junior colleges. Others learn in medic programs of the Armed Forces. Most of these training programs last from 9 months to one year; some junior college programs last 2 years and lead to an associate degree. The American Medical Association is currently evaluating and approving many of these programs.

Students in junior colleges and vocational schools get classroom training as well as supervised clinical experience. Required courses include anatomy, physiology, and microbiology. Practical application courses include the care and safety of patients during surgery, use of anesthesia and its hazards, and nursing procedures. They also learn how to sterilize instruments, prevent and control infection, and handle special drugs, solutions, supplies, and equipment.

The Association of Operating Room Technicians awards a certificate to operating room technicians who pass their comprehensive examination. A Certified Operating Room Technician (CORT) is recognized as competent in the field and is generally paid a higher salary.

Manual dexterity is a necessity for operating room technicians since they must handle various instruments quickly. They must be orderly and emotionally stable.

Employment Outlook

Employment opportunities for operating room technicians are expected to be excellent through the mid-1980's. Graduates of 2-year junior college programs should be especially in demand.

Employment of operating room technicians is expected to grow very rapidly as more routine nursing responsibilities are delegated to them. As a result, operating room nurses may concentrate on duties that require their professional training. The same factors that contribute to the demand for health workers in general apply to operating room technicians, namely population growth and the increased ability of people to pay for medical care due to expansion in coverage under prepayment insurance programs.

In addition to job openings resulting from growth of the occupation, many new operating room technicians will be needed to replace workers who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

Depending on training and other qualifications, monthly salaries of inexperienced operating room technicians generally ranged from $454 to $578 in 1972-73, according to a National Survey conducted by the University of Texas Medical Branch. Junior college graduates earn higher salaries than workers without training. Salaries also vary widely from one part of the country to the other, with those in the East and West Coasts generally higher. Salaries of experienced technicians ranged from $519 to $751 per month. In general, operating room technicians earn about as much as average non-supervisory workers in private industries except farming.

Operating room technicians usual-

ly work a 5-day, 40-hour week. However, they may be required to work "on call" shifts, for which they receive compensation.

Sources of Additional Information

Additional information on a career as an operating room technician and on training programs for the occupation is available from:

Association of Operating Room Technicians, Inc., 1100 West Littleton Blvd., Suite 101, Littleton, Colo. 80120.

OPTOMETRIC ASSISTANTS

Nature of the Work

Optometric assistants perform a wide variety of tasks, allowing optometrists to devote more time to their professional duties. Their tasks range from assisting in eye examinations to bookkeeping.

Optometric assistants keep patients' records, schedule appointments, and handle bookkeeping, correspondence, and filing. They prepare patients for eye examinations and help optometrists test for near and distant eyesight, color blindness, and tension of or pressure on the eyeball. Optometric assistants measure patients for correct and comfortable fit of glasses. They suggest size and shape of eyeglass frames to compliment the patient's facial features, and adjust finished eyeglasses by heating, shaping, and bending the plastic or metal frames. They also assist the optometrist in fitting contact lenses and in giving instructions on the use and care of the lenses.

Optometric assistants help patients with exercises for eye coordination to overcome focusing defects.

Optometric assistants also work in the laboratory. They modify conventional glasses or contact lenses to assure proper fit, insert lenses in frames, repair frames, keep an inventory of optometric materials, and clean and care for the instruments.

In a large optometric complex, assistants may specialize in visual training, chairside assistance, or office administration. In a smaller practice, they may assume all these duties.

Places of Employment

About 11,000 persons, most of them women, worked as optometric assistants in 1972. Most worked for optometrisits in private practice. Others worked for health clinics, optical instrument manufacturers, or government agencies. Some served as assistants to optometrists in the Armed Forces.

Training, Other Qualifications, and Advancement

Most optometric assistants are trained on the job in their employers' offices. Training also can be acquired in 1 year academic courses; four schools offered this type of training in 1972. More detailed training in the technical aspects of optometry was available in seven schools that offered 2-year courses leading to an associate degree. One university offered a 4-year program in optometric technology.

High school graduation or its equivalent, including courses in mathematics and office procedures,

is preferred for on-the-job training or admission to a formal training program. All of the formal programs offer specialized courses such as the anatomy and physiology of the human eye, orthoptics (correction of defective vision), and contact lens theory and practice. Programs also include courses in secretarial and office procedures. Lectures and laboratory work are supplemented by actual experience in optometric clinics and practices.

Although there are relatively few programs for training optometric assistants, a recent study indicated that over 4 optometrists out of 5 feel that a 1 or 2-year course, followed by some on-the-job instruction, is the best preparation. This training will become more important in gaining initial employment and advancement as more programs become available.

Manual dexterity, accuracy, and the ability to distinguish shades of color are requirements for persons planning to become optometric assistants. Because of the person-to-person work relationship between optometric assistants and patients, a neat appearance, courtesy, and tact are important qualifications.

Employment Outlook

The employment of optometric assistants is expected to grow very rapidly through the mid-1980's. Employment opportunities for optometric assistants who have completed one of the few formal training programs should be excellent. On-the-job training, however, probably will continue to be the means by which most persons enter the occupation. The availability of many positions which require fewer than 8 hours of work a day offers opportunities for continued employment while caring for a family.

Factors underlying the expected growth of the occupation are the increase in population and greater demand for eye care services. As the number of patients served by optometrists increase, more trained assistants will be needed.

Earnings and Working Conditions

Earnings of optometric assistants vary by geographical region, academic and technical qualifications, and the size and type of practice of the optometrists employing them. In 1972, beginning salaries ranged from $80 a week for optometric assistants having no training or experience to $160 a week for experienced and highly trained assistants, according to limited information available.

Most optometric assistants work between 30 and 40 hours a week, but about 1 out of 10 works shorter hours. Occasionally they may work a few hours on Saturday. The work is not strenuous and physical surroundings are usually pleasant.

Sources of Additional Information

Further information on a career as optometric assistant and a list of training programs are available from:

American Optometric Association, 7000 Chippewa St., St. Louis, Mo. 63119.

RADIOLOGIC (X-RAY) TECHNOLOGISTS

(D.O.T. 078.168 and .368)

Nature of the Work

Medical X-rays play a major role in the diagnostic and therapeutic fields of medicine. Radiologic technologists, also called medical X-ray technologists and X-ray technicians, operate X-ray equipment. They are usually supervised by radiologists (physicians who specialize in the use of X-rays).

Most radiologic technologists use X-ray equipment to take pictures of internal parts of the patient's body. They may prepare chemical mixtures, such as barium salts, which the patients swallow to make specific organs appear clearly in X-ray examinations (recorded in radiographs). The technologist uses radiation protection devices and techniques to safeguard himself, as well as the patient, against possible radiation hazards. After determining the correct voltage, current, and desired exposure time, the technologist positions the patient and makes the required number of radiographs to be developed for interpretation by the physician. The technologists may use mobile X-ray equipment at a patient's bedside and in surgery. The technologist also is usually responsible for keeping treatment records.

Some radiologic technologists do radiation therapy work. They help physicians treat patients with diseases, such as certain types of cancer, by administering prescribed doses of X-ray or other forms of radiation to the affected areas of the body. They also may assist the radiologists in measuring and handling radium and other radioactive materials.

Other technologists work in the field of nuclear medicine in which radioactive isotopes are used to diagnose and treat diseases. They help the radiologist prepare and administer the prescribed radioisotope and operate special equipment for tracing and measuring radioactivity.

Places of Employment

About 55,000 persons—about

two-thirds of them women—worked as radiologic technologists in 1972.

Hospitals employ about three-fourths of all radiologic technologists; most of the remainder work in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and public school systems. A few work as members of mobile X-ray tuberculosis detection teams.

Training, Other Qualifications, and Advancement

The requirement for entry into this field is the completion of a formal training program in X-ray technology. In 1972, about 1,200 programs in X-ray technology offered in hospitals, medical schools affiliated with hospitals, colleges, and community colleges were approved by the American Medical Association (AMA). In addition to training programs in approved schools, training also may be obtained in the military service. Some courses in X-ray technology are offered by vocational or technical schools. Programs usually take 24 months to complete. A few schools offer 3- or 4-year programs, and about 30 schools award a bachelor's degree in X-ray technology.

All schools accept only high school graduates. Courses in mathematics, physics, chemistry, biology, and typing are helpful.

X-ray technology programs usually include courses in anatomy, physiology, nursing procedures, physics, radiation protection, darkroom chemistry, principles of radiographic exposure, X-ray therapy, radiographic positioning, medical ethics, department administration, and the operation and maintenance of equipment.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements include graduation from an approved school of medical X-ray technology and the satisfactory completion of a written examination. After registration, the title "Registered Technologist, (ARRT)" may be used. Once registered, technologists may be certified in radiation therapy or nuclear medicine, by completing an additional year of combined classroom study and work experience.

Good health and stamina are important qualifications for this field.

As openings occur, some technologists in large X-ray departments may qualify as instructors in X-ray techniques or advance to chief X-ray technologists.

Employment Outlook

Radiologic technologists are expected to have favorable opportunities for both full- and part-time work through the mid-1980's. The occupation is expected to grow rapidly through the mid-1980's, because of wide use of X-ray equipment in diagnosis and treatment of diseases, and the expansion of prepayment medical programs that make medical care available to patients who would otherwise be unable to afford it. Radiotherapy also is expected to find increased uses, opening more jobs in the years ahead. X-raying of large groups will be extended as part of disease control programs.

In addition to radiologic technologists needed to fill new jobs, a large number of new workers will be needed to replace those who die, retire, or leave the field.

Earnings and Working Conditions

Starting salaries of radiologic technologists employed in hospitals and medical centers averaged about $150 a week in 1972, according to a national survey conducted by the University of Texas Medical Branch.

The Federal Government paid new graduates of AMA approved schools of X-ray technology starting salaries of $6,882 a year in early 1973.

Full-time technicians generally work 8 hours a day and 40 hours a week but may be "on call" for some weekend or night emergency duty. Sick leave, vacations, insurance, and other benefits are comparable to those covering other workers in the same organization.

There are potential radiation hazards in this field; however, these hazards have been greatly reduced by the modern use of special safety devices such as individual instruments that measure radiation exposure, lead aprons, gloves, and other shieldings.

Sources of Additional Information

For additional information about a career in radiologic technology write:

The American Society of Radiologic Technologists, 645 North Michigan Ave., Chicago, Ill. 60611.

The American Registry of Radiologic Technologists, 2600 Wayzata Boulevard, Minneapolis, Minn. 55405.

RESPIRATORY THERAPISTS

(D.O.T. 079.368)

Nature of the Work

Respiratory therapists and technicians, sometimes called inhalation therapists, treat patients with respiratory problems. This treatment may range from giving temporary relief to patients with chronic asthma or emphysema to giving emergency care in cases of heart failure, stroke, drowning, and shock. Respiratory therapists also are among the first medical specialists called for emergency treatment of acute respiratory conditions arising from head injury or drug poisoning. The short span of time for which a patient can safely cease to breathe emphasizes the highly responsible role of the respiratory therapist. If breathing has stopped for longer than 3 to 5 minutes, there is little chance that the patient can recover without brain damage, and if oxygen is cut for more than 9 minutes, he will die.

Respiratory therapists follow doctors' orders and use special equipment such as respirators and positive-pressure breathing machines to administer gas therapy, aerosol therapy, and other treatments involving respiration. They also show patients and their families how to use the equipment at home.

Other duties include keeping records of the cost of materials and charges to patients, and maintaining and making minor repairs to equipment.

Respiratory therapists and respiratory therapy technicians perform essentially the same duties. However, the therapist is expected to have a higher level of expertise and may be expected to assume some teaching and supervisory duties.

Places of Employment

About 17,000 people worked as respiratory therapists or technicians in 1972—about one-half were women. Most work in respiratory therapy, anesthesiology, or pulmonary medicine departments of hospitals. Others work for oxygen equipment rental companies, ambulance services, nursing homes, and universities. Women are increasingly entering this field, which has been mostly staffed by men.

Training, Other Qualifications, and Advancement

Respiratory apparatus has become increasingly complex in recent years and, although a few therapists are trained on the job, formalized training is now stressed as the requisite for entry to the field.

In 1972, more than 100 institutions offered educational programs in respiratory therapy approved by the Council on Medical Education of the American Medical Association. High school graduation is required for entry. Courses vary in length between 18 months and 4 years and include both theory and clinical work. A bachelor's degree is awarded for completion of a 4-year program and lesser degrees are awarded for shorter courses. Areas of study include human anatomy and physiology, chemistry,

physics, microbiology, and mathematics. Technical courses offered deal with procedures, equipment, and clinical tests.

Respiratory therapists with an associate degree from an AMA-approved program and 1 year of experience are eligible to be registered by the American Registry of Inhalation Therapists (ARIT). Applicants must pass written and oral examinations. In 1972, nearly 1,800 therapists had been registered. A registered inhalation therapist often can advance faster and obtain a higher position than one who is not registered. An increasing number of employers recognize registration as an acknowledgement of a therapist's qualifications.

Those who do not qualify or fail to pass the registry examination may elect to take the examination to become Certified Respiratory Therapy Technicians. This CRTT examination is less comprehensive than the registry examination. To be eligible for it, applicants must have completed either an associate degree respiratory therapy program or a 1-year respiratory therapy technician program, either of which must be approved by the Council on Medical Education of the American Medical Association.

Respiratory therapists can advance to positions as assistant chief, chief therapist, or, with graduate education, instructor of respiratory therapy at the college level.

People who want to enter the respiratory therapy field should be able to work with patients and understand their physical and psychological needs. Respiratory therapists must be able to pay attention to detail, follow instructions, and work as part of a team. Operating the complicated respiratory therapy equipment also requires some mechanical ability.

Employment Outlook

Employment opportunities for respiratory therapists and technicians are expected to be very good through the mid-1980's. Those with advanced training in respiratory therapy programs will be in demand to fill teaching and supervisory positions.

A rapid growth in employment of respiratory therapists is expected, owing to new uses for respiratory therapy, increased acceptance of its use, and the growth in health services in general. Many specialists in respiratory therapy will be hired to release nurses and other personnel now performing respiratory therapy work to return to their primary duties. Many other openings will arise from the need to replace those who retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

The starting salary of respiratory therapy personnel employed in hospitals and medical centers averaged about $604 a month in 1972, according to a survey conducted by the University of Texas Medical Branch. Top salaries of respiratory therapists in hospitals ranged as high as $960 a month.

The Federal Government paid respiratory therapists starting salaries of $6,128 a year in 1973 if they had 1 year of post-secondary training, and $6,882 for those with 2 years of training. Some therapists employed by the Federal Government in early 1973 earned as much as $12,373 a year.

Respiratory therapists who work in hospitals receive the same benefits as other hospital personnel, including hospitalization, paid vacations, and sick leave. Some institutions provide tuition assistance or free courses, pension programs, uniforms, and parking.

Therapists generally work a 40-hour week. After-hours and weekend duty is generally required since most hospitals have 24-hour coverage throughout the week. Adherence to safety precautions and testing proper operation of equipment minimizes the potential hazard of fire to therapists and patients.

Sources of Additional Information

Information concerning education programs is available from:

American Association for Respiratory Therapy, 7411 Hines Place, Dallas, Tex. 75235.

On-the-job training information can be obtained at local hospitals.

NURSING OCCUPATIONS

The nursing field, consisting of registered nurses; licensed practical nurses; and nursing aides, orderlies, and attendants, accounts for about one-half of total employment among health service workers. Nursing personnel perform a variety of duties to care for and comfort the sick, the injured, and others requiring medical services.

This section deals in detail with the three basic nursing occupations.

Registered nurses (RN's) are the Nation's second largest group of professionally employed women. Only teaching employs larger numbers. Following doctors' orders, these nurses dispense medications and treatments, and observe and monitor patients' progress. Some become head nurses and are responsible for all nursing services of a specified area of an institution.

Licensed practical nurses provide skilled nursing care to sick, injured, and convalescent patients. They work under the general supervision of physicians and registered nurses, and may sometimes supervise nursing aides, orderlies, and attendants.

Nursing aides, orderlies, and attendants make up the largest group of nursing personnel. They provide for the care and comfort of patients. They serve meals, feed patients, and do other tasks that free professional and practical nurses for more critical work requiring professional and technical training.

Those seeking to be registered nurses, licensed practical nurses, and nursing aides, orderlies, and attendants should genuinely like working with people, since they must work closely with other members of the health team and care for patients who are uncomfortable and sometimes irritable. Nursing workers must be thoroughly reliable and possess a level head in emergencies, since lives may depend on them.

REGISTERED NURSES

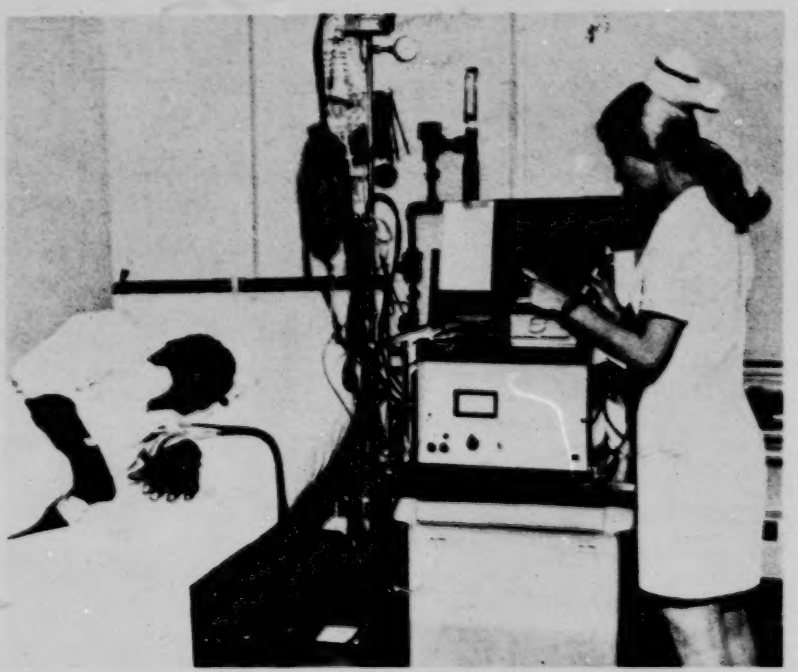
(D.O.T. 075.118 through .378)

Nature of the Work

Nursing care plays a major role in providing health care. As important members of the medical care team, registered nurses perform a wide variety of duties. They administer medications; observe, evaluate, and record symptoms, reactions, and progress of patients; assist in the rehabilitation of patients; and help maintain a physical and emotional environment that promotes patient recovery.

Some registered nurses provide hospital care. Other's perform research activities or instruct students. The type of employment setting usually determines the scope of the nurse's duties.

Hospital nurses constitute the largest group. Most are staff nurses who provide skilled bedside nursing care and carry out medical treatment plans prescribed by physicians. They may also supervise practical nurses, aides, and orderlies. Hospital nurses usually work with groups



Registered nurse monitors patient receiving treatment for kidney disease.

of patients that require similar nursing care. For instance, some nurses work with post-surgery patients; others care for children, the elderly, or the mentally ill. Some are administrators of nursing services.

Private duty nurses give individual care to patients who need constant attention. The private duty nurse may sometimes care for several hospital patients who require special care, but not full-time attention.

Office nurses assist physicians, dental surgeons, and occasionally dentists in private practice or clinics. Sometimes they perform routine laboratory and office work in addition to their nursing duties.

Public health nurses care for patients in clinics, homes, schools and other community settings. They instruct patients and families in proper care, and give periodic care as prescribed by a physician. They may also instruct groups of patients in proper diet and arrange for immunizations. These nurses work with community leaders, teachers, parents, and physicians in community health education. Some public health nurses work in schools.

Nurse educators teach students the principles and skills of nursing, both in the classroom and in direct patient care. They also conduct continuing education courses for registered nurses, practical nurses and nursing assistants.

Occupational health or industrial nurses provide nursing care to employees in industry and government, and along with physicians promote employee health. As prescribed by a doctor, they treat minor injuries and illnesses occurring at the place of employment, provide for the needed nursing care, arrange for further medical care if necessary, and offer health counseling. They also may assist with health examinations and inoculations.

(Licensed practical nurses who also perform nursing service are discussed elsewhere in the *Handbook*).

Places of Employment

Nearly 750,000 persons—all but 1 percent women—worked as registered nurses in 1972. About one-third of them worked on a part-time basis.

More than two-thirds of all registered nurses worked in hospitals, nursing homes, and related institutions. About 60,000 were office nurses and about 50,000 were private duty nurses who cared for patients in hospitals and private homes. Public health nurses in government agencies, schools, visiting nurse associations, and clinics numbered about 54,000; nurse educators in nursing schools accounted for about 35,000; and occupational health nurses in industry, about 20,000. Most of the others were staff members of professional nurse and other organizations, State boards of nursing, or working for research organizations.

Training, Other Qualifications, and Advancement

A license is required to practice professional nursing in all States and in the District of Columbia. To obtain a license, a nurse must be a graduate of a school approved by the State board of nursing and pass the State board examination. Nurses may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

Three types of educational programs—diploma, baccalaureate, and associate degree—offer the education required for basic careers in registered nursing. Education at the master's level and above is required for positions in research, consultation, teaching, and clinical specialization. Graduation from high school is required for admission to all schools of nursing.

Diploma programs are conducted by hospital and independent schools and usually require 3 years of training. Bachelor's degree programs usually require 4 years of study in a college or university, although a few require 5 years. Associate degree programs in junior and community colleges require approximately 2 years of nursing education. In addition, several programs provide licensed practical nurses with the training necessary to upgrade themselves to registered nurses while they continue to work part-time. These programs generally offer an associate of arts degree. In early 1972, more than 1,360 programs (associate, diploma, and baccalaureate) were offered in the United States. In addition, about 80 colleges and universities offered master's and doctoral degree programs in nursing.

Programs of nursing include classroom instruction and supervised nursing practice in hospitals and health facilities. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and basic nursing care. They also get supervised clinical experience in the care of patients who have different types of health problems. Students in bachelor's degree programs as well as in some of the other programs are assigned to public health agencies to learn how to care for patients in clinics and in the patients' homes. General education is combined with nursing education in baccalaureate and associate degree programs and in some diploma programs.

Qualified students who need financial aid can get a nursing scholarship or a low-interest loan under the provisions of the Nurse

Training Act of 1971.

Depending on length of service, up to 85 percent of the loan can be cancelled over a 5-year period for full-time employment as a professional nurse in any public or nonprofit institution or agency. Full-time employment in an area identified as a shortage area can make one eligible for cancellation of 85 percent of the loan over a three-year period.

Young persons who want to pursue a nursing career should have a sincere desire to serve humanity and be sympathetic to the needs of others. Nurses must be able to follow orders precisely and to use good judgment in emergencies; they also should be able to accept responsibility and direct or supervise the activity of others. Good mental health is helpful in order to cope with human suffering and frequent emergency situations. Staff nurses may need physical stamina because of the amount of time spent walking and standing.

From staff positions in hospitals, experienced nurses may advance to head nurse, assistant director, and director of nursing services. A master's degree, however, often is required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. In public health agencies, advancement is usually difficult for nurses who do not have degrees in public health nursing.

A growing movement in nursing, generally being referred to as the "nurse practitioner program" is opening up new career possibilities. Nurses who wish to take the extra training are preparing for highly independent roles in the clinical care and teaching of patients. They are practicing in primary roles which include nurse-midwifery, maternal care, pediatrics, family health, and the care of medical patients.

Employment Outlook

Employment opportunities for registered nurses are expected to be favorable through the mid-1980's. However, if trends in the number of persons enrolling in schools of nursing continue, some competition for more desirable, higher paying jobs may develop by the mid-1980's. Opportunities for full- or part-time work in present shortage areas such as some Southern States and many inner-city areas are expected to be very favorable through 1985. For nurses who have had graduate education, the outlook is excellent for obtaining positions as administrators, teachers, clinical specialists, public health nurses, and for work in research.

A very rapid increase in employment of registered nurses is expected because of rising population, improved economic status of the population, extension of prepayment programs for hospitalization and medical care, expansion of medical services as a result of new medical techniques and drugs, and increased interest in preventive medicine and rehabilitation of the handicapped. In addition to the need to fill new positions, large numbers of nurses will be required to replace those who leave the field each year because of marriage and family responsibilities.

Earnings and Working Conditions

Registered nurses who worked in hospitals in 1972 received average starting salaries of $8,100 a year, according to a national survey conducted by the University of Texas Medical Branch. This was slightly above average for nonsupervisory workers in private industry, except farming. Registered nurses in nursing homes can expect to earn slightly less than those in hospitals. Salaries of industrial nurses averaged $158 a week in early 1971, according to a survey conducted by the Bureau of Labor Statistics (BLS).

In early 1973, the Veterans Administration paid inexperienced nurses who had a diploma or an associate degree starting salaries of $8,572 a year; those with baccalaureate degrees, $10,012. Graduates of associate degree programs entered at $8,256, and those who had a baccalaureate degree or diploma began at $8,722 in other Federal Government agencies.

Most hospital nurses receive extra pay for work on evening or night shifts. Nearly all receive at least 2 weeks of paid vacation after 1 year of service. Most hospital nurses receive from 5 to 13 paid holidays a year and also some type of health and retirement benefits.

Sources of Additional Information

For information on approved schools of nursing, nursing careers, loans, scholarships, salaries, working conditions, and employment opportunities, contact:

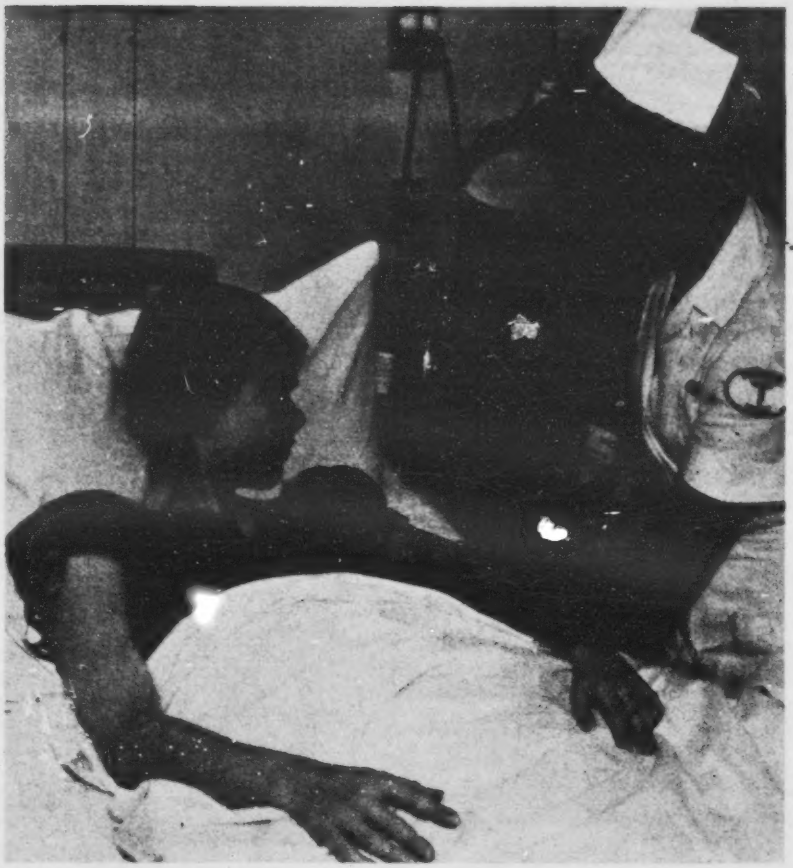
ANA Committee on Nursing Careers, American Nurses' Association, 2420 Pershing Rd., Kansas City, Mo. 64108.

Information about employment opportunities in the Veterans Administration is available from:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

LICENSED PRACTICAL NURSES

(D.O.T. 079.378)



Nature of the Work

Licensed practical nurses help care for the physically or mentally ill and infirm. Under the direction of physicians and registered nurses, they provide nursing care that requires technical knowledge but not the professional training of a registered nurse. (See statement on Registered Nurses.) In California and Texas, licensed practical nurses are called *licensed vocational nurses*.

In hospitals, licensed practical nurses provide much of the bedside care needed by patients. They take and record temperatures and blood pressures, change dressings, administer certain prescribed medicines, and help bed patients with bathing and other personal hygiene. They assist physicians and registered nurses in examining patients and in carrying out nursing procedures. They also assist in the delivery, care, and feeding of infants, and help registered nurses in recovery rooms by reporting any adverse changes in patients. Some licensed practical nurses help supervise hospital attendants. (See statement on Nursing Aides, Orderlies, and Attendants.)

Licensed practical nurses who work in private homes provide mainly day-to-day patient care that seldom involves highly technical procedures or complicated equipment. In addition to providing nursing care, they may prepare meals and care for the patient's comfort and morale. They also teach family members how to perform simple nursing tasks.

In doctors' offices and in clinics, licensed practical nurses prepare patients for examination and treatment. They also may make appointments and record information about patients.

Places of Employment

About 430,000 persons—the great majority of them women—worked as licensed practical nurses in 1972. Hospitals employed about three-fifths of all licensed practical nurses. Most of the others worked in nursing homes, clinics, doctors' offices, sanitariums, and other long-term care facilities. Many worked for public health agencies and welfare and religious organizations. Some were self-employed, working in hospitals or the homes of their patients.

Training, Other Qualifications, and Advancement

All States and the District of Columbia regulate the preparation and licensing of practical nurses. To be licensed, students must complete a course of instruction in practical nursing that has been approved by the State board of nursing and pass a licensing examination.

Educational requirements for enrollment in State-approved training programs range from completion of eighth or ninth grade to high school graduation. Many schools do not require completion of high school but give preference to graduates. Physical examina-

tions and aptitude tests are usually required.

In 1972, nearly 1,300 State-approved programs provided practical nursing training. Public schools offered more than half of these programs as part of their vocational and adult education programs. Other programs were available at junior colleges, local hospitals, health agencies, and private educational institutions.

Practical nurse training programs are generally one year long and include both classroom study and clinical practice. Classroom instruction covers nursing concepts and principles and related subjects including anatomy, physiology, medical-surgical nursing, administration of drugs, nutrition, first aid, and community health. Students learn to apply their skill to an actual nursing situation through supervised hospital work.

Aspiring licensed practical nurses should have a deep concern for human welfare. They must be emotionally stable because working with sick and injured people sometimes can be upsetting.

As part of a health care team, they must be able to follow orders and work under close supervision. Good health is very important, as is the physical stamina needed to work while standing up a great deal.

Advancement opportunities are limited without additional training. In-service educational programs prepare some licensed practical nurses for work in specialized areas. There are also some career ladder programs. Under this concept, nurses' aides attend training to become licensed practical nurses (LPN's) while continuing to work part time. Similarly, LPN's may prepare to become registered nurses while they continue to work part time.

Employment Outlook

The employment outlook for licensed practical nurses is expected to be very good through the mid-1980's. Employment is expected to continue to rise very rapidly through the mid-1980's in response to a growing population, the increasing ability of persons to pay for health care, and the continuing expansion of public and private health insurance plans. Jobs will be created also as licensed practical nurses take over duties previously performed by registered nurses. Also, thousands of newly licensed practical nurses will be needed each year to replace those who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

The average starting salary of licensed practical nurses who worked in hospitals and medical schools was about $120 a week in 1972, according to a national survey conducted by the University of Texas Medical Branch.

Public health agencies paid licensed practical nurses salaries that averaged about $6,600 a year in 1972. Federal hospitals offered beginning licensed practical nurses annual salaries ranging from $6,128 to $6,882 in early 1973, according to personal qualifications and the geographical area.

Many hospitals give periodic pay increases after specific periods of satisfactory service. Some hospitals provide free lodging and laundering of uniforms. Practical nurses generally work 40 hours a week, but often this workweek includes some work at night and on weekends and holidays. Many hospitals provide paid holidays and vacations, health insurance, and pension plans.

In private homes, licensed practical nurses usually work 8 to 12 hours a day and go home at night.

Sources of Additional Information

A list of State-approved training programs and information about practical nursing is available from:

ANA Committee on Nursing Careers, American Nurses' Association, 2420 Pershing Rd., Kansas City, Mo. 64108.

National Association for Practical Nurse Education and Service, Inc., 122 East 42nd St., Suite 800, New York, N.Y. 10017.

National Federation of Licensed Practical Nurses, Inc., 250 West 57th St., New York, N.Y. 10019.

Information about employment opportunities in U.S. Veterans Administration hospitals is available from your local Veterans Administration hospital, as well as:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

NURSING AIDES, ORDERLIES, AND ATTENDANTS

(D.O.T. 355.687 through 355.887)

Nature of the Work

Nursing aides, orderlies, and attendants perform a variety of duties to care for sick and injured people. Women usually are called nursing aides and men generally are known as orderlies. Other job titles include *hospital attendant, nursing assistant, auxiliary nursing worker, home health aide,* and (in mental institutions) *psychiatric aide.*

Nursing aides and orderlies answer patients' bell calls and deliver messages, serve meals, feed patients who are unable to feed

themselves, make beds, and bathe and dress patients. They also may give massages, take temperatures, and assist patients in getting out of bed and walking. Orderlies provide many of the same services. Orderlies also escort patients to operating and examining rooms and transport and set up heavy equipment. Some attendants may work in hospital pharmacies or supply rooms.

The duties of nursing aides depend on the policies of the institutions where they work, the type of patient being cared for, and—equally important—the capacities and resourcefulness of the nursing aide or orderly. In some hospitals, they may clean patients' rooms and do other household tasks. In others, under the supervision of registered nurses and licensed practical nurses, they may assist in the care of patients. The tasks performed for patients differ considerably, and depend on whether the patient is confined to his bed following major surgery, is recovering after a disabling accident or illness, or needs assistance with daily activities because of infirmity caused by advanced age.

Places of Employment

About 900,000 persons worked as nursing aides, orderlies, and attendants in 1972; more than four-fifths were women. Most of them work in hospitals. Others work primarily in nursing homes and other institutions that provide facilities for care and recuperation. A small number give supportive services to patients in their homes.

Training, Other Qualifications, and Advancement

Although some employers prefer high school graduates, many, such as Veterans Administration hospitals, hire non-graduates. Many employers accept applicants 17 or 18 years of age. Others—particularly nursing homes and mental hospitals—prefer to hire more mature men and women who are at least in their mid-twenties.

Nursing aides generally are trained after they are hired. Some institutions combine on-the-job training, under the close supervision of registered or licensed practical nurses, with classroom instruction. Students learn to take and record temperatures, bathe patients, change linens on beds that are occupied by patients, and move and lift patients. Training may last several days or a few months, depending on the policies of the hospital, the complexity of the duties and the aide's aptitude for the work. The Manpower Development and Training Act and the Vocational Education Act provide funds for many programs which train nursing aides.

Courses in home nursing and first aid, offered by many public school systems and other community agencies, provide a useful background of knowledge for the work. Volunteer work and temporary summer jobs in hospitals and similar institutions also are helpful. Applicants should be healthy, tactful, patient, understanding, emotionally stable, and dependable. Nursing aides, as other health workers, should have a genuine desire to help people, be able to work as part of a team, and be willing to accept some menial tasks.

Opportunities for promotions are limited without further training.

Nurses' aides contribute to the comfort and care of patients.

Some acquire specialized training to prepare for better paying positions such as hospital operating room technician.

To become licensed practical nurses, nursing aides must complete the year of specialized training required for licensing. Some in-service programs allow nursing aides to get this training while they continue to work part-time.

Employment Outlook

Employment of nursing aides is expected to increase very rapidly through the mid-1980's. In addition to those needed because of occupational growth, many thousands of nursing aides will be needed each year to replace workers who die, retire, or leave the occupation for other reasons.

Most jobs for nursing aides and orderlies are in hospitals, but many new openings will be in nursing homes, convalescent homes, and other long-term care facilities. Major reasons for expected occupational growth are the increasing need for medical care of a growing population, including a larger proportion of elderly people; the increasing ability of people to pay for health care; the growth of public and private health insurance plans; and the expanded medical services of Medicare and Medicaid. Employment opportunities also will arise as hospitals continue to delegate to nursing aides tasks which, although associated with patient care, do not require the training of registered and licensed practical nurses.

Earnings and Working Conditions

Nursing aides, orderlies, and attendants earned slightly less than the average for all nonsupervisory workers on private payrolls, except farming. Nursing aides employed full time by nursing homes and related facilities earned considerably less than those in hospitals. Depending on the experience of the applicant, salaries of inexperienced nursing aides in Veterans Administration hospitals ranged from $92 to $102 a week in early 1973.

With few exceptions, the scheduled workweek of attendants in hospitals is 40-hours or less. Because nursing care must be available to patients on a 24-hour-a-day basis, scheduled hours include night-work and work on weekends and holidays.

Attendants in hospitals and similar institutions generally received paid vacations which, after 1 year of service, may be a week or more in length. Paid holidays and sick leave, hospitalization and medical benefits, and pension plans also are available to many hospital employees.

Sources of Additional Information

Information about employment may be obtained from local hospitals and State and metropolitan health career programs.

Additional information about the work of nursing aides, orderlies, and attendants may be obtained from:

ANA Committee on Nursing Careers, American Nurses' Association, 2420 Pershing Rd., Kansas City, Mo. 64108.

Division of Careers and Recruitment, American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, Vocational Education Act, and other programs that provide training opportunities.

THERAPY AND REHABILITATION OCCUPATIONS

Through various types of therapy, handicapped people, particularly the physically disabled, can learn to build satisfying and productive lives. Helping in this therapy are rehabilitation workers who use exercise, massage, heat, light, and water as well as mechanical and scientific devices to treat a variety of disorders. They work on a health care team, led by a physician, with nurses, social workers, psychologists, and vocational counselors.

This chapter presents statements on three areas of therapy and rehabilitation: speech pathology and audiology, physical therapy, and occupational therapy.

Speech pathologists and *audiologists* are the largest rehabilitation and therapy group. They help people with speech and hearing impairments to overcome their handicap.

Physical therapists and *physical-therapist assistants and aides* use exercise, massage, and heat to help disabled people regain the use of their muscles.

Occupational therapists and *occupational therapy assistants* plan and lead activities which help disabled people regain coordination. Eventually, they help the patient learn a skill which can be used to find employment. They also help elderly people in nursing homes become involved in interesting and absorbing hobbies.

People who work in the therapy and rehabilitation occupations should have concern for the physical and emotional well-being of others. They must have patience and be able to establish and maintain effective personal relationships. Therapists should be stable, since patients who receive therapy often also need help to cope emotionally with their disability.

Other occupations also provide opportunity for work with the disabled and handicapped. Rehabilitation counselors give personal and vocational guidance to the physically, mentally, or socially handicapped. Employment counselors work with the disabled as well as the able-bodied in career planning and job adjustment. Both occupations are described elsewhere in the *Handbook*.

OCCUPATIONAL THERAPISTS

(D.O.T. 079.128)

Nature of the Work

Occupational therapists plan and direct educational, vocational, and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They evaluate the capacities and skills of patients and plan a therapy program with other members of a medical team which may include physicians, physical therapists, vocational counselors, nurses, social workers, and other specialists.

About 1 therapist out of 3 works with emotionally handicapped patients, and the rest work with physically disabled persons. These patients represent all age groups and degrees of illness. Patients participate in occupational therapy to determine the extent of abilities and limitations; to regain physical, mental, or emotional stability; to relearn daily routines such as eating, dressing, writing, and using a telephone, and eventually, to prepare for employment.

Occupational therapists teach manual and creative skills such as weaving and leather working, and business and industrial skills such as typing and the use of power tools. They also plan and direct activities especially for children. Therapists may design and make special equipment or splints to help disabled patients.

Besides working with patients, occupational therapists supervise student therapists, occupational therapy assistants, volunteers, and auxiliary nursing workers. The chief occupational therapists in hospitals may teach medical and nursing stu-

dents the principles of occupational therapy. Many therapists administer occupational therapy programs, coordinate patient activities, or are consultants to local and State health departments and mental health agencies. Some teach in colleges and universities.

Places of Employment

About 7,500 people, more than 9 out of 10 of them women, worked as occupational therapists in 1972. More than three-fourths of all occupational therapists work in hospitals. Rehabilitation centers, nursing homes, schools, outpatient clinics, community mental health centers, and research centers employ most of the others. Some work in special sanitariums or camps for handicapped children, others in State health departments. Still others work in home-care programs for patients unable to attend clinics or workshops. Some are members of the Armed Forces.

Training, Other Qualifications, and Advancement

A degree or certificate in occupational therapy is required to enter the profession. In 1972, 40 colleges and universities offered programs in occupational therapy which were accredited by the American Medical Association and the American Occupational Therapy Association. All but one of these schools offer bachelor's degree programs. Some schools have 2 year programs and accept students who have completed 2 years of college. Some also offer shorter programs, leading to a certificate or a master's degree in occupational therapy for students who have a bachelor's degree in another field. One school offers the master's degree only. A graduate degree often is required for teaching, research, or administrative work.

Course work in occupational therapy programs includes physical, biological, and behavioral sciences and the application of occupational therapy skills. Students also work in hospitals or health agencies to gain clinical experience. After students complete the 6 to 9 month clinical practice period and graduate from their programs, they are eligible for the American Occupational Therapy Association examination to become registered occupational therapists (O.T.R.). Occupational therapy assistants who are certified by the association and have 2 years of approved work experience also are eligible to take the examination to become registered occupational therapists.

Personal qualifications needed in this profession include emotional stability and a sympathetic but objective approach to illness and disability. Occupational therapists also need ingenuity, imagination, and the ability to teach.

Newly graduated occupational therapists generally begin as staff therapists. After several years on the job, they may qualify as senior therapists or specialized practitioners. Some advance to supervisory or administrative jobs in occupational therapy programs; a few teach or do research.

Employment Outlook

Employment opportunities for occupational therapists are expected to be favorable through the mid-1980's. The increasing number of graduates is expected to be roughly in balance with new openings that are expected to result from growth of the occupation and replacement for those who will die, retire, or leave the occupation for other reasons.

Public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs are expected to create very rapid growth in the employment of occupational therapists. Many therapists will be needed to staff community health centers and extended care facilities and to work with psychiatric patients, children with cerebral palsy, and elderly persons with heart disease.

Earnings and Working Conditions

Beginning salaries for new graduates of occupational therapy programs averaged about $8,500 a year in 1972, according to a national survey conducted by the University of Texas Medical School at Galveston. Experienced occupational therapists earned an average salary of about $10,200 a year; some earned as much as $13,000.

In early 1973, beginning therapists employed by the Veterans Administration earned starting salaries of $8,572 a year. Most experienced, nonsupervisory occupational therapists earned about $11,600 annually.

Many part-time positions are available for occupational therapists. Some organizations require evening work.

Sources of Additional Information

For more information on occupational therapy as a career write to:

American Occupational Therapy Association, 6000 Executive Blvd., Rockville, Md. 20852.

OCCUPATIONAL THERAPY ASSISTANTS

(D.O.T. 079.368)

Nature of the Work

Occupational therapy assistants work under the supervision of professional occupational therapists to help rehabilitate patients who are physically and mentally disabled. Through educational, vocational, and recreational activities they help plan and carry out programs to strengthen patients' muscle power, increase motion and coordination, and develop self-sufficiency in overcoming disabilities.

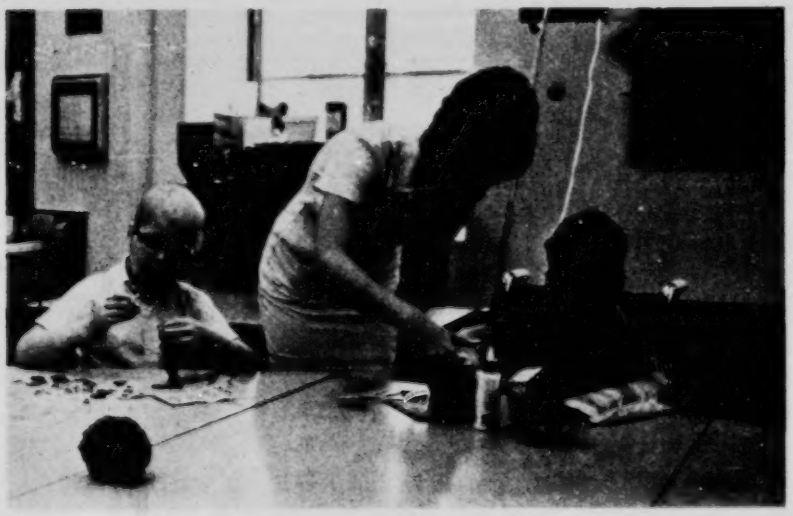
Occupational therapy assistants teach patients creative skills such as woodworking, ceramics, and graphic arts, or work-related recreational and social activities such as games, dramatics, and gardening. They also teach self-care skills such as eating, dressing, and shaving.

Assistants must be able to teach a broad range of skills because of the wide variety of patients. They may work either with groups or with individual patients. When treating patients with diseases, assistants usually work under the supervision of professional occupational therapists. In other situations, such as organizing crafts projects for handicapped persons living in institutions, they may function independently, with only periodic consultation with professionals.

Besides working directly with patients, occupational therapy assistants may order supplies, prepare work materials, and help maintain tools and equipment. They also may keep patients' records, prepare clinical notes, and perform other clerical duties.

Places of Employment

About 6,000 people worked as occupational therapy assistants in 1972; most were women. Most occupational therapy assistants work in hospitals. Others work in nursing homes for the aged, schools for handicapped children and the mentally retarded, rehabilitation and day care centers, special workshops, and out-patient clinics. A small number are members of the Armed Forces.



Training, Other Qualifications, and Advancement

Most occupational therapy assistants qualify through on-the-job training received in hospitals and other health care facilities. Some learn their skills in vocational, technical, and adult education programs. Other assistants graduate from 1- or 2-year junior college programs, or have completed an approved military occupational therapy assistant training program.

In early 1973, there were 31 programs approved by the American Occupational Therapy Association. Most of these are 2-year college programs leading to an associate degree. Others are 1-year vocational school programs and a few are hospital-based and last 25 weeks. Graduates of these programs may be certified by the American Occupational Therapy Association and receive the title Certified Occupational Therapy Assistant (COTA). In 1972, about 2,200 employed occupational therapy assistants were COTA's.

Approved programs combine classroom instruction with at least 2 months of supervised practical experience. Courses include the history and philosophy of occupational therapy, structure and function of the human body, the effect of illness and injury on patients, and human development. Students also learn skills and crafts and their application to physical and mental disabilities.

Applicants for training programs must be high school graduates or the equivalent. Preference is given to applicants who have taken courses in science and crafts and have previous experience as nursing aides.

Occupational therapy assistants should sincerely like people, have good physical and mental health, and be able to establish and maintain effective personal relationships.

They also should be able to work well with their hands since they must teach patients how to use tools and materials.

Occupational therapy assistants who work in large health facilities begin with routine tasks and may advance to more responsible levels as they gain experience. Experienced COTA's may take the exam to become a registered occupational therapist (OTR) without completing the remaining 2 years of study for a bachelor's degree in occupational therapy.

Employment Outlook

Employment opportunities for occupational therapy assistants are expected to be very good through the mid-1980's, particularly for graduates of approved programs. Many openings will be created each year by growth in the occupation and the need to replace those who die, retire, or leave the occupation for other reasons. Although the number of occupational therapy assistant programs is expected to increase, the supply of new graduates is likely to fall short of demands. Thus, the outlook should be favorable for people who want to enter the field through on-the-job training.

Public interest in the rehabilitation of disabled people is expected to cause very rapid growth in the employment of occupational therapy assistants. All types of health care institutions, especially nursing homes and community health centers, will need more occupational therapy assistants through the mid-1980's.

Earnings and Working Conditions

In 1972, annual salaries generally ranged from $6,000 to $7,000 for inexperienced assistants. Experienced occupational therapy assistants earned between $6,500 and $8,000 a year, according to limited information available. Those who completed an approved program generally earned higher starting salaries than beginners without any training.

Occupational therapy assistants may work outside with their patients in pleasant weather. Some work evenings, weekends, and part time.

Sources of Additional Information

For information about work opportunities and programs offering training for occupational therapy assistants, contact:

American Occupational Therapy Association, 6000 Executive Blvd., Rockville, Md. 20852.

PHYSICAL THERAPISTS

(D.O.T. 079.378)

Nature of the Work

Physical therapists help persons with muscle, nerve, joint, and bone diseases or injuries to overcome their resulting disabilities. Their patients include accident victims, crippled children, and disabled older persons. Physical therapists perform and interpret tests and measurements for muscle strength, motor development, functional capacity, and respiratory and circulatory efficiency to develop programs for treatment. They evaluate the effectiveness of the treatment and discuss the patients' progress with physicians, psychologists, occupational therapists, and other specialists. When advisable, physical therapists revise the therapeutic procedures and treatments. They help disabled persons to accept their physical handicaps and adjust to them. They show members of the patients' families how to continue treatments at home.

Therapeutic procedures include exercises for increasing strength, endurance, coordination, and range of motion; stimuli to make motor activity and learning easier; instruction in carrying out everyday activities and in the use of helping devices; and the application of massage, heat and cold, light, water, or electricity to relieve pain or improve the condition of muscles.

Most physical therapists provide direct care to patients as staff members, supervisors, or self-employed practitioners. These therapists either may treat many categories or patients or else may specialize in pediatrics, geriatrics, amputations, arthritis, or paralysis. Others administer physical therapy programs, teach, or are consultants.

Places of Employment

About 18,000 persons—3 out of 4 of them women—worked as licensed physical therapists in 1972. About three-fourths of all physical therapists work in hospitals or nursing

homes; others, in rehabilitation centers or schools for crippled children. Some who work for public health agencies treat chronically sick patients in their own homes. Still others work in physicians' offices or clinics, teach in schools of physical therapy, or work for research organizations. A few serve as consultants in government and voluntary agencies or are members of the Armed Forces.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license to practice physical therapy. Applicants for a license must have a degree or certificate from a school of physical therapy and to qualify must pass a State board examination. In 1972, 59 schools of physical therapy were approved by the American Medical Association and the American Physical Therapy Association.

Most of the approved schools of physical therapy offer bachelor's degree programs. Some schools provide 1- to 2-year programs for students who have completed some college courses. Other schools accept those who already have a bachelor's degree and give a 12- to 16-month course leading to a certificate in physical therapy. Many schools offer both degree and certificate programs.

The physical therapy curriculum includes science courses such as anatomy, physiology, neuroanatomy, and neurophysiology, also specialized courses such as biomechanics of motion, human growth and development, and manifestations of disease and trauma. Besides receiving classroom instruction, students get supervised practical experience administering physical therapy to patients in a hospital or treatment center.

Several universities offer the master's degree in physical therapy. A graduate degree, combined with clinical experience, increases the opportunities for advancement, especially to teaching, research, and administrative positions.

Therapists must have patience, tact, resourcefulness, and emotional stability in order to help patients and their families understand the treatments and adjust to their handicaps. Physical therapists also should have manual dexterity and physical stamina. Many persons who want to determine whether they have the personal qualities needed for this occupation volunteer for summer or part-time work in the physical therapy department of a hospital or clinic.

Employment Outlook

Employment opportunities for physical therapists are expected to be favorable through the mid-1980's. The rapidly growing number of new graduates is expected to be in rough balance with the average number of openings that will result each year from growth in the occupation and from replacement of those who will die or retire.

Employment in the occupation is expected to grow very rapidly through the mid-1980's because of increased public recognition of the importance of rehabilitation. As programs to aid crippled children and other rehabilitation activities expand, and as growth takes place in nursing homes and other facilities for the elderly, many new positions for physical therapists are likely to be created. Many part-time positions should continue to be available.

Earnings and Working Conditions

Starting salaries for new physical therapy graduates averaged about $8,700 a year in 1972, according to a national survey conducted by the University of Texas Medical School at Galveston. Earnings of experienced physical therapists averaged $10,400; some earned as much as $17,000.

Beginning therapists employed by the Veterans Administration (VA) earned starting salaries of $8,572 a year in early 1973. Most experienced nonsupervisory physical therapists in the VA earned about $11,600 annually, those who are supervisors, about $16,700.

Sources of Additional Information

Additional information is available from:

American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20036.

PHYSICAL THERAPIST ASSISTANTS AND AIDES

(D.O.T. 355.878)

Nature of the Work

Physical therapist assistants and aides work under the supervision of professional physical therapists to rehabilitate disabled persons so that they may again lead useful and productive lives. They work to restore physical functions and prevent disability from injury or illness.

Assistants help physical therapists perform tests on patients to determine the best treatment for them and assist in administering it. They use special therapy equipment to apply heat, cold, light, sound, and massage, and report to supervisors or professionals the patient's response to treatment. Assistants also help patients perform therapeutic exercises as well as

everyday activities such as walking and climbing stairs. They help fit artificial limbs, braces, and splints, and instruct patients in their use.

Physical therapist aides help patients prepare for treatment, and may remove and replace for the patients such devices as braces, splints, and slings, and transport patients to and from treatment areas. They may help assistants or therapists in administering treatment to patients. Aides care for and assemble physical therapy treatment equipment. They also keep patients' records, make appointments, act as receptionists, and perform other clerical duties.

Some small health care institutions employ only 1 person besides the therapist in the physical therapy department. In this case, the assistant or aide assumes most of the duties listed for both groups, within the limits of their training.

Places of Employment

About 10,500 persons worked as physical therapist assistants and aides in 1972; most of them were women. Most work in physical therapy departments of general and specialized hospitals. Others work in physicians' or physical therapists' offices and clinics, rehabilitation centers, or nursing homes for the chronically ill and elderly. Some community and government health agencies, schools for crippled children, and facilities for the mentally retarded also employ physical therapist assistants and aides. A small number are members of the Armed Forces.

Training, Other Qualifications, and Advancement

In 1972, 14 States licensed physical therapist assistants who had completed an approved 2-year associate degree program. Some of these States also licensed experienced physical therapist assistants who passed a proficiency test and who had learned their skills in vocational, technical, or adult education programs, or from on-the-job training before associate degree programs were available.

There were 36 programs for physical therapist assistants in 1972; most are in junior or community colleges. Courses include history and philosophy of rehabilitation, human anatomy and physiology, human growth and development, and psychology. A course in physical therapist assistant procedures covers massage, therapeutic exercises, heat and cold therapy, and functional activities. Supervised clinical experience also is a requirement of physical therapist assistant programs. Between 1967, when the first programs were developed, and 1972, 645 persons graduated from 2-year physical therapist assistant programs. About 60 percent were women.

Physical therapist aides qualify for their occupation through training received on the job in hospitals and other health care facilities. The length and content of on-the-job programs vary widely, depending on the level of duties that aides are permitted to perform, the particular services required by different patients when the program is in progress, and the amount of time professional physical therapists can spend teaching trainees. Applicants admitted to on-the-job training programs for physical therapist aides generally must be high school graduates or the equivalent. Employers usually prefer that they have science courses and previous hospital experience as nurse aides.

Physical therapist assistants and aides need good physical and mental

health, manual dexterity to adjust equipment, body coordination to assist in positioning patients, and a sincere interest in helping the physically handicapped.

As physical therapist assistants and aides gain experience, they may advance to more responsible duties with corresponding pay increases. Advancement opportunities for aides are best in areas where associate degree programs for physical therapist assistants are not available.

Employment Outlook

Job opportunities for physical therapist assistants and aides are expected to be excellent through the mid-1980's. In communities where there are large classes in a physical therapist assistant program, some graduates may find it necessary to move to other locations where there are no associate degree programs available. On the national level, however, openings for physical therapist assistants caused by growth and replacement needs will far exceed graduates from these programs.

The expected very rapid growth in the occupation will accompany the growing demand for professional physical therapists. Overall demands in the physical therapy field stem from increased public awareness of the importance of rehabilitation and the growing number of nursing homes which provide therapeutic services to the elderly. Expanded physical therapy services planned by hospitals, nursing homes, schools for crippled children, facilities for mentally retarded, and other health and rehabilitation centers are expected to further increase the need for physical therapist assistants and aides.

Earnings

In 1972, weekly salaries averaged about $90 for beginning physical therapist aides and about $120 for those with experience, according to limited information available. Physical therapist assistants received higher salaries than aides, beginning at about $120 a week. Experienced physical therapist assistants earned as much as $165 weekly.

Sources of Additional Information

Information on a career as a physical therapist assistant or aide and on programs offering training for physical therapist assistant is available from:

The American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

SPEECH PATHOLOGISTS AND AUDIOLOGISTS

(D.O.T. 079.108)

Nature of the Work

About 1 out of 10 Americans is unable to speak or hear clearly. Children who have trouble speaking or hearing cannot participate fully with other children in play or in normal classroom activities. Adults having speech or hearing impairments often have problems in job adjustment. Speech pathologists and audiologists provide direct services to these people by evaluating their speech or hearing disorders and then providing treatment.

The speech pathologist works with children and adults who have speech, language, and voice disorders resulting from causes such as total or partial hearing loss, brain injury, cleft palate, mental retardation, emotional problems, or foreign dialect. The audiologist primarily assesses and treats hearing problems. Speech and hearing, however, are so interrelated that to be competent in one of these fields, one must be familiar with both.

The duties of speech pathologists and audiologists vary with education, experience, and place of employment. In clinics, either in schools or other locations, they use diagnostic procedures to identify and evaluate speech and hearing disorders. Then, in cooperation with physicians, psychologists, physical therapists, and counselors, they develop and implement an organized program of therapy. Some speech pathologists and audiologists conduct research such as investigating the causes of communicative disorders and improving methods for clinical services. Others supervise clinical activities or do other administrative work.

Speech pathologists and audiologists in colleges and universities instruct in the principles and bases of communication, communication disorders, and clinical techniques; participate in educational programs with physicians, nurses, and teachers; and work in university clinics and research centers.

Places of Employment

About 27,000 persons, three-fourths of them women, worked as speech pathologists and audiologists in 1972. About two-thirds worked in public schools. Colleges and universities employed many in classrooms, clinics, and research centers. The rest were distributed among hospitals, speech and hearing centers, government agencies, industry, and private practice.

Training, Other Qualifications, and Advancement

Although only a few States presently require a master's degree for

work in schools, the master's degree or its equivalent increasingly is needed. A teacher's certificate often is required. In addition, some States require workers dealing with handicapped children to have special training. Speech pathologists and audiologists who supervise many Federal programs, such as Medicare and Medicaid, need a master's degree.

Undergraduate courses in speech pathology and audiology include anatomy, biology, physiology, physics, linguistics, semantics and phonetics. Courses in speech and hearing as well as in child psychology and psychology of the exceptional child are also helpful. This training is usually available at colleges that offer a broad liberal arts program.

In 1972, more than 200 colleges and universities offered graduate education in speech pathology and audiology. Courses at the graduate level include advanced anatomy and physiology of the areas involved in hearing and speech, acoustics, and psychological aspects of communication. Training also is given in the analysis of speech production, language abilities, and auditory processes. Graduate students gain a familiarity with research methods used to study speech and hearing.

Scholarships, fellowships, assistantships and traineeships are available in this field. Teaching and training grants to colleges and universities that have programs in speech and hearing are given by the U.S. Rehabilitation Services Administration, the Maternal and Child Health Service, the U.S. Office of Education, and the National Institutes of Health. In addition, some Federal agencies distribute money to colleges to aid graduate students in speech and hearing programs.

Opportunity for advancement, as in most health service occupations, is generally not an important consideration for speech pathologists and audiologists. However, meeting the American Speech and Hearing Association's (ASHA) requirements for a Certificate of Clinical Competence usually is necessary in order to advance professionally and to earn a higher salary. ASHA members work in all areas of speech pathology and audiology. Most speech pathologists and audiologists have some administrative responsibilities. However, directors of speech and hearing clinics, and coordinators of speech and hearing in schools, health departments or government agencies, may be totally involved in administration.

Speech pathologists and audiologists should like people; have the ability to approach problems objectively; and should be sensitive, patient, and emotionally stable. A person who desires a career in speech pathology and audiology should be able to accept responsibility, work independently, and direct others. The ability to work with detail is important. Speech pathologists and audiologists have an opportunity for self-expression and receive satisfaction from seeing the results of their work.

Employment Outlook

The employment of speech pathologists and audiologists is expected to increase moderately through the mid-1980's. For those who have completed graduate study, opportunities are expected to be very good. Although some jobs will be available for those having only a bachelor's degree, the increasing emphasis being placed on the master's degree by State governments and Federal agencies will limit opportunities at the bachelor's level.

Population growth which will increase the number of persons having speech and hearing problems is one of the principal factors underlying the expected moderate increase in employment of speech pathologists and audiologists through the mid-1980's. In addition, the trend is growing toward earlier recognition and treatment of hearing and lan-

guage problems in children. Many school-age children, thought to have learning disabilities, actually have language disorders which speech pathologists can treat.

Other factors expected to increase demand for speech pathologists and audiologists are the rapid expansion in expenditures for medical research and the growing public interest connected with speech and hearing disorders. These are illustrated by the Elementary and Secondary Education Act, as amended, which provides for the education of handicapped children, and expanded Federal programs such as Medicare and Medicaid.

Earnings and Working Conditions

Median salaries of speech pathologists and audiologists teaching in colleges and universities range from $9,900 to $18,500 for a 9-10 month contract in 1972, according to limited data available. Median salaries might be as much as $2,000 higher for an 11 to 12 month contract. Many experienced speech pathologists and audiologists in colleges and universities supplement their regular salaries by doing consulting work, special research projects, and writing books and articles.

In 1972, speech pathologists and audiologists in schools averaged $11,500 for a 9-10 month contract according to limited information available. Their average salaries were over $1,000 higher than those of all classroom teachers for the same period.

In early 1973, the annual starting salary in the Federal Government for speech pathologists and audiologists with a master's degree was $11,614. Those having a doctoral degree were eligible to start at $13,996.

Many speech pathologists and audiologists work over 40 hours a week. Almost all receive fringe benefits such as paid vacations, sick leave, and retirement programs.

Sources of Additional Information

State departments of education can supply information on certification requirements for those who wish to work in public schools.

A list of college and university programs and a booklet on student financial aid as well as general career information are available from:

American Speech and Hearing Association, 9030 Old Georgetown Rd., Washington, D.C. 20014.

OTHER HEALTH OCCUPATIONS

DIETITIANS

(D.O.T. 077.081 through .168)

Nature of the Work

Dietitians plan nutritious and appetizing meals to help people maintain or recover good health. They also supervise the food service workers who prepare and serve the meals, manage purchases and keep the accounts, and give advice on good eating habits. Administrative dietitians form the largest group in this occupation; the others are clinical, teaching, and research dietitians. Nutritionists also are included in this field.

Administrative dietitians apply the principles of nutrition and sound management to large-scale meal planning and preparation, such as that done in hospitals, universities, schools, and other institutions. They supervise the planning, preparation, and service of meals; select, train, and direct food-service supervisors and workers; budget for and purchase food, equipment, and supplies; enforce sanitary and safety regulations; and prepare records and reports. Dietitians who are directors of a dietetic department also decide on departmental policy; coordinate dietetic service with the activities of other departments; and are responsible for the development and management of the dietetic department budget, which in large organizations may amount to millions of dollars annually.

Clinical dietitians, sometimes called therapeutic dietitians, plan diets and supervise the service of meals to meet the nutritional needs of patients in hospitals, nursing homes, or clinics. Among their duties, clinical dietitians confer with doctors and other members of the health care team about the patients' nutritional care, instruct patients and their families on the requirements and importance of their diets, and suggest ways to help them stay on these diets after leaving the hospital or clinic. In a small institution, one person may be both the administrative and clinical dietitian.

Research dietitians evaluate and interpret research findings to improve the nutrition of people in health and in disease. This research may be in nutrition science and education, food management, food service systems and equipment. They conduct studies and make surveys of food intake, food acceptance, and food utilization in the body for individuals and groups of people. Research projects may relate to subjects such as nutritional needs of the aging, persons with a chronic disease, or space travelers.

Dietetic educators teach normal nutrition and nutrition in disease to dietetic, medical, dental, and nursing students and to interns, residents, and other members of the health care team. This may be in hospitals, clinics, and schools.

Nutritionists counsel people of all ages, as individuals or in groups

A therapeutic dietitian instructing a patient about his diet.

on sound nutrition practices, to maintain and improve health. This includes food budgeting and purchasing, and meal planning and preparation. Nutritionists in the public health field are responsible for planning, developing, administering, and coordinating nutrition programs and services as part of public health programs.

An increasing number of dietitians work as consultants to hospitals and to health-related facilities. Others act as consultants to commercial enterprises, including food processors, equipment manufacturers, and utility companies.

Places of Employment

About 33,000 persons, most of them women, worked as dietitians in 1972. More than two-fifths work in hospitals and clinics, including about 1,000 in the Veterans Administration and the U.S. Public Health Service. Colleges, universities, and school systems employ a large number of dietitians as teachers or as dietitians in food service systems. Most of the rest work for public health agencies, restaurants, or cafeterias and large companies that provide food service for their employees. Some dietitians are commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

A bachelor's degree, preferably with a major in foods and nutrition or institution management, is the basic educational requirement for dietitians. This degree can be earned in more than 250 colleges and universities, usually in departments of home economics. College courses usually required are in food and nutrition, institution management, chemistry, bacteriology, physiology, and related courses such as mathematics, data processing, psychology, sociology, and economics.

For a dietitian to qualify for professional recognition, the American Dietetic Association recommends the completion after graduation of an approved dietetic internship or 2 years experience. In 1972, 75 internship programs were approved by the American Dietetic Association. A growing number of coordinated undergraduate programs, located in schools of medicine and in allied health and home economics departments of both colleges and universities, enable students to complete both the requirements for a bachelor's degree and the clinical experience requirement in four years.

Experienced dietitians may advance to assistant director or director of a dietetic department in a large hospital or other institution. Advancement to higher level positions in teaching and research usually requires graduate education; public health nutritionists must earn a graduate degree in this field. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Persons who plan to become dietitians should have organizational and administrative ability, as well as high scientific aptitude, and should be able to work well with a variety of people.

Employment Outlook

Employment opportunities for qualified dietitians on both a full-time and part-time basis are expected to be good through the mid-1980's. In recent years, dietetic assistants trained in vocational and technical schools and dietetic technicians trained in junior colleges have increasingly been utilized by employers to help meet demands for dietetic services. Since this situation is likely to persist, employment opportunities also should continue to be favorable for graduates of these programs.

Employment of dietitians is expected to grow rapidly to meet the nutrition and food management needs of hospitals and extended care facilities, schools, industrial plants, and restaurants. Dietitians also will be needed to staff community health programs and to conduct research in food and nutrition. In addition to new dietitians needed because of occupational growth, many others will be required each year to replace those who die, retire, or leave the profession for marriage and family responsibilities.

The number of men dietitians is growing. Men are likely to find increasing employment opportunities, especially as administrative dietitians in college and university food services, hospitals, and commercial eating places.

Earnings and Working Conditions

Starting salaries of hospital dietitians averaged $8,800 a year in 1972, according to a national survey conducted by the University of Texas Medical Branch. Experienced dietitians received annual salaries ranging from $8,400 to $14,700. Colleges and universities paid dietitians with bachelor's degrees average salaries of $10,700 a year in 1972, according to the American Dietetic Association. Dietitians who worked in commercial or industrial establishments averaged about $12,300; those in public and voluntary health agencies, $10,800. Self-employed dietitians with a bachelor's degree earned over $14,000 a year, in 1972; some, with Ph.D.'s, averaged as much as

$21,000 yearly.

The entrance salary in the Federal Government for those completing an approved internship was $9,500 in early 1973. Beginning dietitians with a master's degree who had completed an internship earned $11,600. Nutrition consultants working in State and local governments averaged salaries of $9,900 to $12,800 in 1972.

Most dietitians work 40 hours a week; however, dietitians in hospitals may sometimes work on weekends, and those in commercial food service have somewhat irregular hours. Some hospitals provide laundry service and meals in addition to salary. Dietitians usually receive paid vacations, holidays, and health insurance and retirement benefits.

Sources of Additional Information

For information on approved dietetic internship programs, scholarships, and employment opportunities, and a list of colleges providing training for a professional career in dietetics, contact:

The American Dietetic Association, 620 North Michigan Ave., Chicago, Ill. 60611.

The U.S. Civil Service Commission, Washington, D.C. 20415, will send information on the requirements for dietetic interns and dietitians in Federal Government hospitals.

HOSPITAL ADMINISTRATORS

(D.O.T. 187.118)

Nature of the Work

Hospital administrators hold the highest executive positions in hospitals and manage all administrative activities. They usually receive general guidance from a hospital governing board in developing plans and policies.

Administrators direct and coordinate the varied activities of the hospital, and are responsible for the personnel, equipment, finances, building, and services provided by the hospital. Administrators work closely with the medical and nursing staffs to determine the needs for additional personnel and equipment. They also plan, with the help of their business staff, for current and future space needs, purchase of supplies and equipment, and provision of patients' services such as mail and laundry. The preparation and administration of the budget are important responsibilities of the administrator. With the help of a hospital engineer, the administrator is responsible for insuring that the buildings and equipment are properly maintained.

In small hospitals, administrators assume all management duties. In large hospitals they are assisted by specialists trained either in hospital administration or in specialized managerial skills such as purchasing, public relations, or labor relations.

Under the direction of the governing board, administrators may carry out large projects to expand or develop the hospital's services, such as organizing fund-raising campaigns or planning new medi-

cal care, research, or educational programs.

Administrators meet regularly with their staff to discuss progress, make plans, and solve problems concerning the operations of the hospitals. Working with the medical staff and department heads, they may develop and maintain teaching programs for nurses, interns, and other hospital staff members as well as cooperative educational programs in allied health with colleges and universities. Administrators also may address community gatherings, organize community health campaigns, and participate in planning community health care programs.

Places of Employment

About 17,000 persons worked as hospital administrators and assistants in 1972. About two-thirds worked in nonprofit or private hospitals. The remainder worked in Federal, State, and local government hospitals. Of those employed by the Federal Government, most worked in Veterans Administration, Armed Forces, and Public Health Service hospitals.

About 15 percent of all administrators and their assistants are women; many are members of religious orders.

Hospital administrators are located in cities and towns throughout the country, but most are in large population centers.

Training, Other Qualifications, and Advancement

Educational requirements for hospital administrators vary. Most hospitals prefer applicants having at least a master's degree in health and hospital administration from an accredited graduate program. Some prefer formal training in social or behavioral sciences, industrial engineering, or business administration, along with extensive experience in the health field. A few require their administrators to be physicians or registered professional nurses. Specialized hospitals (such as mental or orthopedic hospitals) may prefer physicians whose medical specialty is the same as that of the hospital. Hospitals run by religious groups may seek administrators of the same faith.

In 1972, 38 colleges and universities offered master's degree programs in health and hospital administration. The programs generally last 2 years, but vary in time allocated to academic study and to supervised administrative experience in hospitals or health agencies. The minimum amount of required academic study is about a year; supervised administrative experience requirements range up to a year.

The curriculum may include courses such as hospital organization and management, medical care, accounting and budget control, personnel administration, public health administration, and the economics of health care. The chief administrator of the affiliated hospital or his assistant supervise students as they gain experience in all phases of hospital administration. A Ph.D. in health administration, offered in several universities, is especially helpful for those who want to teach and do research.

The American College of Hospital Administrators provides financial loans and scholarships to a limited number of students for graduate work in health and hospital administration. Some Federal Government awards for graduate training in health and hospital administration also are available.

A growing number of colleges and universities offer bachelor's degree programs in health administration. These prepare students for middle management positions in hospitals or other health care institutions such as nursing homes or community health centers. Some community colleges offer an associate degree in health administration which prepares students for assistant administrative positions in smaller health care institutions.

New graduates having a master's degree in health and hospital administration usually enter the field as assistant administrators or department heads and occasionally as administrators in small hospitals. Some persons who do not have a master's degree in health and hospital administration enter the field by working in one of the specialized administrative areas such as personnel, records, budget and finance, or data processing. With this experience and some graduate work, they may be promoted to department head, to assistant administrator, and eventually some become a chief administrator.

Personal qualifications needed for success as a hospital administrator include initiative and interest in community service. Administrators should be able to work with and inspire people, organize and direct large-scale activities. They also must be good public speakers.

Employment Outlook

Employment opportunities for new graduates having the master's degree in hospital administration are expected to be favorable through the mid-1980's. Applicants who do not have graduate education will find it increasingly difficult to enter this field in upper management positions in hospitals and other health programs. A few positions for administrators are likely to continue to be filled by physicians, persons in other professional medi-

cal occupations, or persons experienced in a specialized administrative area.

The number of positions in hospital administration is expected to grow very rapidly through the mid-1980's, as health facilities are expanded to provide additional health services to an increasing population. A trend towards more complex organization in hospitals also is expected to create new openings for administrative assistants. However, the number of master's programs in health and hospital administration also has grown very rapidly since the mid-1960's. If these trends continue through the 1970's, the number of graduates can be expected to be adequate to meet the growth in the occupation.

The position of hospital administrator, especially in a large hospital, is a career goal which is attained by only a few of the graduates of a master's degree program in hospital administration, and is generally filled by promotion from within the hospital. However, there are a growing number of administrative positions available to these graduates in other health care institutions such as large nursing or personal care homes and in public health departments. Still other positions will be open to them in voluntary health organizations which are State or nationwide in scope.

Earnings and Working Conditions

Salaries of hospital administrators depend on factors such as size, type, and location of the hospital, and size of its administrative staff and budget. Administrative assistants in hospitals earned an average starting salary of $9,780 in 1972, according to a national survey conducted by the University of Texas Medical School at Galveston. Experienced administrative assistants in very large hospitals earned up to $18,000 or more.

Average salaries of chief hospital administrators ranged between $21,000 and $25,000 in 1972, according to a survey conducted for the American College of Hospital Administrators. Many earned over $40,000.

Salaries of experienced VA hospital administrators, many of them physicians, ranged from $31,203 to $36,000 in early 1973.

Commissioned officers in the Armed Forces who work as hospital administrators hold ranks ranging from second lieutenant to colonel or from ensign to captain. Commanding officers of large Armed Forces hospitals are usually physicians who may hold higher ranks. Hospital administrators in the U.S. Public Health Service are commissioned officers, holding ranks ranging from lieutenant (junior grade) to captain in the Navy.

Hospital administrators often work long hours. Since hospitals operate on a round-the-clock basis, the administrator may be called on to settle emergency problems at any time of the day or night. He also may be called on to attend meetings held at various locations outside the hospital.

Source of Additional Information

Information about hospital administration and a list of colleges and universities offering this training are available from:

American College of Hospital Administrators, 840 North Lake Shore Dr., Chicago, Ill. 60611.

Association of University Programs in Health Administration, One Dupont Circle NW., Washington, D.C. 20036.

For information on Federal Government awards for graduate training in hospital administration, contact the financial aid office of the individual universities, or:

Bureau of Health Manpower Education, National Institutes of Health, Bethesda, Md. 20014.

MEDICAL RECORD ADMINISTRATORS

(D.O.T. 100.388)

Nature of the Work

All health care institutions keep records that contain medical information on each patient, including case histories of illnesses or injuries, reports on physical examinations, X-rays and laboratory tests, doctors' orders and notes, and nurses' notes. These records are necessary for correct and prompt diagnosis and treatment of illnesses and injuries. They also are used for research, insurance claims, legal actions, evaluation of treatment and medications prescribed, and in the training of medical personnel. Medical information in hospital records also is used to evaluate the effectiveness of a hospital's care, and to plan programs at community health centers.

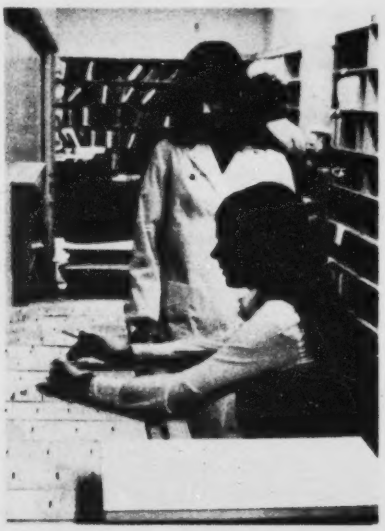
Medical record administrators, also known as medical record librarians, direct the activities of the medical record department and develop systems for documenting, storing, and retrieving medical information. They supervise the work of the medical record staff in the preparation and analysis of records and reports on patients' illnesses and treatment. Among their main duties are training members of the medical record staff for specialized jobs, compiling medical statistics required by State or national health agencies, and assisting medical staff members in evaluation of patient

care and in scientific studies. Medical record administrators represent their departments at hospital staff meetings, and may be called to testify in court about information contained in a medical record.

The size and type of institution employing medical record administrators affects the duties and amount of responsibility assigned to these workers. In large hospitals, chief medical record administrators supervise other medical record administrators, technicians, and clerks. Smaller hospitals may employ only two or three persons in the medical record departments and in nursing homes usually one person keeps the medical records. In these cases, the medical record administrator performs technical and clerical as well as professional duties.

Places of Employment

Most of the 11,600 medical record administrators employed in 1972 worked in hospitals. The remainder worked in clinics, nursing homes, State and local public health departments, and medical research centers. Some health insurance companies also employ medical record administrators to help determine liability for payment of their clients' medical fees. Some medical record administrators work for firms that manufacture equipment for recording and processing medical data and develop and print health insurance and medical forms. Many small health care facilities hire medical record administrators as consultants. Although most medical record administrators are women, the number of men in the occupation is growing.



Medical record administrator obtains information from a patient's record with the help of a technician on her staff.

Training, Other Qualifications, and Advancement

Preparation for a career as a medical record administrator is offered in specialized programs in colleges, universities, and hospitals. Most programs last 4 years and lead to a bachelor's degree in medical record administration. However, concentration in medical record administration begins in the third or fourth year of study, making transfer from a junior college possible. One-year certificate programs also are available for those who already have a bachelor's degree and required courses in the liberal arts and biological sciences. In 1972, there were 31 programs in medical record administration approved by the Council on Medical Education of the American Medical Association and the American Medical Record Association (AMRA).

Training for medical record administrators includes both classroom instruction and experience in hospital medical record departments. Anatomy, physiology, fundamentals of medical science, medical terminology, and medical record science are among the required scientific courses. In addition, management courses such as hospital organization and administration, health law, statistics, and data processing are part of the curriculum. Experience in the medical record departments of hospitals provides students with a practical background in applying standardized medical record practices, compiling statistical reports, analyzing data from the medical records, and organizing medical record systems.

Graduates of approved schools in medical record administration are eligible for the national registration examination given by AMRA. Passing this examination gives professional recognition as a Registered Record Administrator (RRA). There were about 4,750 employed RRA's in 1972, according to AMRA.

Medical record administrators must be accurate and interested in detail. They also must be able to communicate clearly in speech and writing. Because medical records are confidential, medical record administrators must be discreet in processing and releasing information. Supervisors must be able to organize and analyze work procedures and to work effectively with other hospital personnel.

Medical record administrators with some experience in smaller health facilities may advance to positions as department heads in large hospitals or to higher level positions in hospital administration. Some coordinate the medical record departments of several small hospitals. Others move on to medical record positions in health agencies. Many teach in the expanding programs for medical record personnel in 2- and 4-year colleges and universities.

Employment Outlook

Employment opportunities for graduates of approved medical record administrator programs are expected to be excellent through the mid-1980's. Employment is expected to grow very rapidly, with the increasing use of hospitals and other health facilities as more and more people are covered by health insurance. The detailed information required by third-party payers such as insurance companies and Medicare also will cause some growth in the occupation. More consultants will be needed to standardize health records in nursing homes and home care programs. The importance of medical records in research, and the growing use of computers to store and retrieve medical information also should increase the demand for qualified medical record administrators to develop new medical information systems. Part-time employment opportunities also should be available in teaching, in research, and as consultants to health care facilities.

Earnings and Working Conditions

The salaries of medical record administrators are influenced by the location, size, and type of employing institution, as well as by the duties and responsibilities of the position. The average starting salary for medical record administrators in 1972 was $8,760 a year, according to a national survey conducted by the University of Texas Medical Branch at Galveston. Top salaries averaged $10,500 a year, with some earnings as much as $16,000.

Newly graduated medical record administrators employed by the Federal Government generally started at $7,700 a year in early 1973; those having bachelor's degrees and good academic records were eligible to begin at $9,500. Some experienced medical record administrators employed by the Federal Government earned as much as $16,700 annually.

Medical record administrators usually work a regular 40-hour week and receive paid holidays and vacations.

Sources of Additional Information

Information about approved schools and employment opportunities is available from:

The American Medical Record Association, 875 North Michigan Ave., Suite 1850, John Hancock Center, Chicago, Ill. 60611.

PHARMACISTS

(D.O.T. 074.181)

Nature of the Work

Pharmacists dispense drugs and medicines prescribed by medical practitioners and supply and advise people on the use of many medicines that can be obtained with and without prescriptions. Pharmacists must understand the use, composition, and effect of drugs and be able to test them for purity and strength. They also advise physicians on the proper selection and use of medicines. Compounding—the actual mixing of ingredients to form powders, tablets, capsules, ointments, and solutions—is now only a small part of pharmacists' practice, since most medicines are produced by manufacturers in the form used by the patient.

Many pharmacists employed in community pharmacies also have other duties. Besides dispensing medicines, some pharmacists buy and sell nonpharmaceutical merchandise, hire and supervise personnel, and oversee the general operation of the pharmacy. Other pharmacists, however, operate prescription pharmacies that dispense only medicines, medical supplies, and health accessories.

Pharmacists in hospitals and clinics dispense prescriptions and advise the medical staff on the selection and effects of drugs; they also make sterile solutions, buy medical supplies, teach in schools of nursing and allied health professions, and perform administrative duties. An increasing number of hospital pharmacists work in patient care areas as consultants to the medical team.

Some pharmacists, employed as medical sales representatives by drug manufacturers and wholesalers, sell medicines to retail pharmacies and to hospitals, and inform health personnel about new drugs. Others teach in pharmacy colleges, supervise the manufacture of pharmaceuticals, or develop new medicines. Some pharmacists also edit or write articles for pharmaceutical journals, or do administrative work.

Places of Employment

Nearly 131,000 persons worked as licensed pharmacists in 1972; nearly 10 percent were women. About 107,000 pharmacists worked in community pharmacies. Of these community pharmacists, more than two-fifths owned their own pharmacies; the others were salaried employees. Most of the remaining salaried pharmacists worked for hospitals, pharmaceutical manufacturers, and wholesalers. Some were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Others

Pharmacist at poison control center giving emergency instructions for treatment.

served as pharmacists in the Armed Forces, taught in colleges of pharmacy, or worked for State and local government agencies.

Most towns have at least one pharmacy with one or more pharmacists in attendance. Most pharmacists, however, practice in or near cities, and in those States which have the largest populations.

Training, Other Qualifications, and Advancement

A license to practice pharmacy is required in all States and the District of Columbia. To obtain a license, one must be a graduate of an accredited pharmacy college, pass a State board examination and—in nearly all States—have a specified amount of practical experience or internship under the supervision of a registered pharmacist. All States except California, Florida, and Hawaii grant a license without examination to qualified pharmacists already licensed by another State.

At least 5 years of study beyond high school are required to graduate from one of the 73 accredited colleges of pharmacy and receive a Bachelor of Science (B.S.) or a Bachelor of Pharmacy (B. Pharm.) degree. A few colleges that require 6 years award a Doctor of Pharmacy (Pharm. D.) degree at the completion of the program. A few colleges admit students directly from high school and offer all the education necessary for graduation. Most colleges provide 3 or 4 years of professional instruction and require all entrants to have completed their prepharmacy education in an accredited junior college, college, or university.

A prepharmacy curriculum usually emphasizes mathematics and basic sciences, such as chemistry and biology, but also includes courses in the humanities and social sciences. Because entry requirements vary among colleges of pharmacy, prepharmacy students should inquire about and follow the curriculum required by colleges they plan to attend.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. However, a master's or doctor's degree in pharmacy or a related field usually is required for research work or college teaching. Areas of special study include pharmaceutics, pharmaceutical chemistry, pharmacology (study of the effects of drugs on the body), pharmacognosy (study of the drugs derived from plant or animal sources), clinical pharmacy, and pharmacy administration.

Needy students may obtain Federal loans or scholarships up to $3,500 a year to pursue full-time study leading to a degree in pharmacy. Several scholarships are awarded annually by drug manufacturers, chain drug stores, corporations, State and national pharmacy associations, and the colleges of pharmacy.

Since many pharmacists are self-employed, prospective pharmacists should have some business ability, as well as an interest in medical science and the ability to instill confidence in patients. Honesty, integrity, and orderliness are important attributes for the profession. In addition, accuracy is needed to compound and dispense medicines, as well as keep records required by law.

Pharmacists often begin as employees in community pharmacies. After they gain experience and obtain the necessary funds, they may become owners or part-owners of pharmacies. A pharmacist who gains experience in a chain drugstore may advance to managerial positions, and later to a higher executive position within the company. Hospital pharmacists who have the necessary training and experience may advance to director of pharmacy service or to other administrative positions.

Employment Outlook

The employment outlook for pharmacists is expected to be very good through the mid-1980's. Since growth of the occupation is expected to be moderate, most of the openings will result from the death and retirement of persons already in the profession. Overall, job openings are expected to exceed in number the graduates of pharmacy schools.

Employment in the occupation will grow as new pharmacies are established, particularly in residential areas or suburban shopping centers. Many community pharmacies, also, are expected to hire additional pharmacists, because of a trend towards shorter working hours. Population growth, the rising standard of medical care, and the growth of Medicaid and other insurance programs that provide payment for prescription drugs also will generate demand for pharmacists.

Employment in hospitals prob-

ably will rise with the more extensive use of pharmacists for hospital and clinic work. Continued expansion in the manufacture of pharmaceutical products and in research are expected to provide more opportunities for pharmacists in production, research, distribution, and sales. Pharmacists with advanced training will be needed for college teaching and laboratory research.

Earnings and Working Conditions

Earnings of pharmacists employed in chain drug stores averaged about $14,700 in 1972, according to a survey conducted by the National Association of Chain Drug Stores. Pharmacists who are owners or managers of pharmacies often earn more. The entrance salary in the Federal Civil Service for new graduates was about $11,600 a year, in early 1973. With a master's degree or 2 years of graduate studies, the beginning salary was about $14,000.

Annual starting salaries for hospital pharmacists were about $11,100 in 1972, according to a survey conducted by the University of Texas Medical School at Galveston. Top salaries for experienced hospital pharmacists averaged $13,500, and some were as high as $17,500.

Community pharmacists generally work more than the standard 40-hour workweek. Pharmacies often are open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during store hours. Despite the general trend toward shorter hours, 44 hours is still the basic workweek for many salaried pharmacists, and some work 50 hours or more. Self-employed pharmacists often work more hours than those in salaried positions. Those who teach or work for industry, government agencies, or hospitals have shorter workweeks.

Sources of Additional Information

A free packet giving information on pharmacy as a career, preprofessional requirements, and student financial aid is available from:

American Association of Colleges of Pharmacy, Office of Student Affairs, 8121 Georgia Ave., Suite 800, Silver Spring, Md. 20910.

General information on pharmacy is available from:

American Pharmaceutical Association, 2215 Constitution Ave. NW., Washington, D.C. 20037.

Information about chain drug stores is available from:

National Association of Chain Drug Stores, 1911 Jefferson Highway, Arlington, Va. 22202.

For information about retail pharmacies, contact:

National Association of Retail Druggists, One East Wacker Dr., Chicago, Ill. 60601.

A list of accredited colleges is available from:

American Council on Pharmaceutical Education, 77 West Washington St., Chicago, Ill. 60602.

Information on requirements for licensure in a particular State is available from the Board of Pharmacy of that State or from:

National Association of Boards of Pharmacy, 77 West Washington St., Chicago, Ill. 60602.

Information on college entrance requirements, curriculums, and financial aid is available from the dean of any college of pharmacy.

SANITARIANS

(D.O.T. 079.118)

Nature of the Work

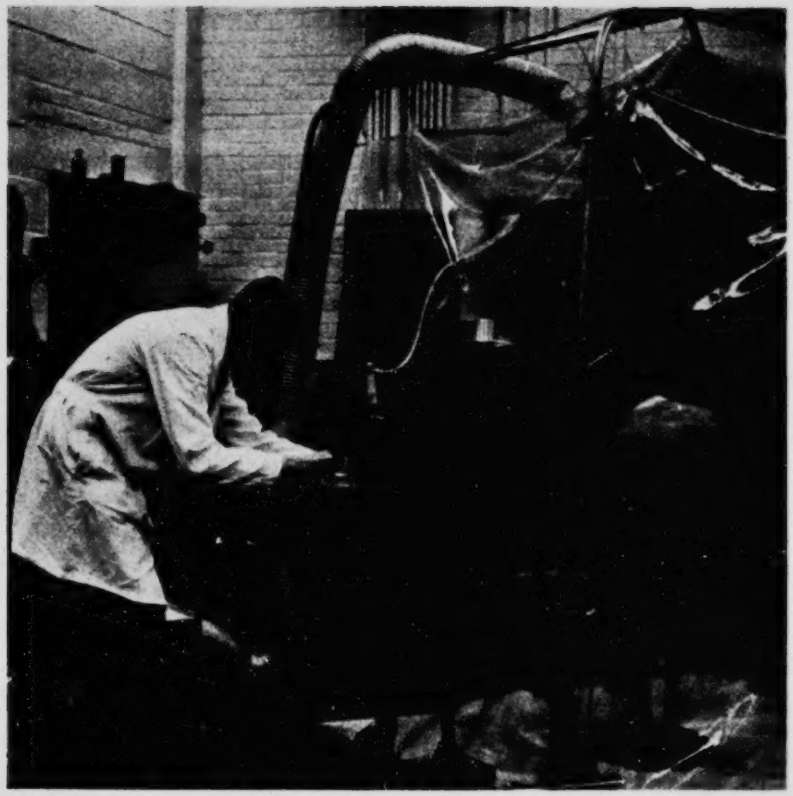
Sanitarians, frequently called environmentalists, are specialists in environmental health. They perform a broad range of duties to protect the cleanliness and safety of the food people eat, the liquids they drink, and the air they breathe.

Sanitarians check the cleanliness and safety of food and beverages produced in dairies and processing plants, or served in restaurants, hospitals, and other institutions. They often examine the handling, processing, and serving of food for compliance with sanitation rules and regulations. Sanitarians also may develop and manage programs to prevent contamination, control insects and rodents, properly dispose of refuse, and insure adequate sanitary water supplies.

Sanitarians concerned with waste control oversee the treatment and disposal of sewage, refuse, and garbage. They examine places where pollution is a danger, perform tests to detect pollutants, and collect air or water samples for analysis. Sanitarians determine the nature and cause of the pollution, then initiate action to stop it.

Public health sanitarians work closely with doctors, nurses, and public health officers to prevent and investigate outbreaks of disease. They may conduct surveys to determine the adequacy of health regulations or perform sanitary inspections of schools, houses, swimming pools, and recreation facilities. They also plan for civil defense and emergency disaster aid. Sometimes sanitarians teach health education classes and lecture to student assemblies, civic groups, and other organizations.

Professional sanitarians work closely with a variety of other workers such as life and environmental scientists, waste water treatment plant operators, and environmental health technicians. Environmental health technicians may help them perform routine duties such as compliance inspections,



Sanitarian uses air samples to check bacteria carried on a hospital worker.

collection of air and water samples, and testing for pollutants.

Sanitarians who have supervisory duties analyze reports of inspection and investigations, and occasionally give evidence in court cases involving violations of sanitation and health regulations. Sanitarians in top administrative positions plan and direct environmental health programs and coordinate them with the programs of other agencies. Other duties may include advising on difficult or unusual environmental health problems, and drafting health laws or regulations.

In large local and State health or agriculture departments, sanitarians may specialize in areas of work such as milk and dairy products, food sanitation, waste control, air pollution, institutional sanitation, and occupational health. In rural areas and small cities, they may be responsible for a wide range of environmental health activities.

Increasing numbers of sanitarians work in private industry to minimize contamination and pollution hazards and make sure that working conditions are healthy, safe, and clean. They frequently work closely with government sanitarians who enforce health, safety, and pollution laws and regulations.

Places of Employment

About 17,000 persons, mostly men, worked as sanitarians in 1972. Three out of every four worked for State and local governments. Most of the remainder worked for producers and processors of food and dairy products. A small number were teachers in colleges and universities. A few were consultants. Others worked in hospitals and for trade associations and other organizations. Most sanitarians work in populous areas.

Training, Other Qualifications, and Advancement

Laws in 35 States provided for the registration of sanitarians in 1972; in some States, registration is mandatory. Although requirements for registration vary considerably among States, the minimum educational requirement usually is a bachelor's degree. A bachelor's degree in environmental health is preferred for beginning sanitarian jobs, although a major in any environmental, life, or physical science generally is acceptable. Administrative, teaching, and research jobs usually require a graduate degree in some aspect of public health.

In 1972, 58 colleges and universities offered undergraduate or graduate programs in environmental health. A typical curriculum leading to a bachelor of science degree in environmental health includes background courses in the humanities, social sciences, mathematics, chemistry, physics, and biology. Core courses include microbiology (bacteriology); biostatistics, epidemiology, environmental sciences, administration, and field work.

Sanitarians usually begin at a trainee level and work under the supervision of experienced sanitarians for up to a year. They receive on-the-job training in environmental health practice, learn to evaluate health and sanitation hazards and recommend corrective action. After a few years of experience, they may be promoted to minor supervisory positions with more responsibilities. Specializa-

tion may begin after several years of experience, especially in large local health offices. Further advancement is possible to top supervisory and administrative positions.

To keep abreast of new developments and to supplement their academic training, many sanitarians take specialized short-term training courses in subjects such as occupational health, water supply and pollution control, air pollution, protection from dangers of radiation, milk and food inspection, metropolitan planning, and hospital sanitation.

Young people interested in becoming sanitarians should like working with detail and possess a mechanical aptitude, since sanitarians may operate various testing devices. An ability to communicate effectively, both orally and in writing is necessary for writing detailed reports and tactfully dealing with persons concerning the correction of unsanitary conditions.

Employment Outlook

Employment opportunities for sanitarians who have a bachelor's degree in environmental health are expected to be very good through the mid-1980's, particularly in private industry. The outlook for those having degrees in life, physical, or environmental sciences is expected to be favorable.

Employment of sanitarians is expected to increase very rapidly through the mid-1980's in response to anticipated expansion of public and private programs dealing with food sanitation, water and air pollution, and occupational health. Underlying the demand for sanitarians in the private sector will be industrial growth and an increasing recognition by industry of its responsibility for safe and sanitary products and healthful environment. Demand for sanitarians in the public sector will be generated by an expansion of the environmental health activities of State and local governments. Increasing public concern with health hazards, waste management, radiation danger, and pollution is expected to require the services of more sanitarians. Population growth, continued migration of people from rural to urban areas, and industrial growth will place a greater strain on food services, housing, and sewage disposal facilities of urban communities.

Earnings and Working Conditions

Starting salaries of sanitarians employed by State governments averaged $7,800 annually, in early 1972, according to a survey of State and selected local governments conducted by the Public Personnel Association. Maximum salaries of journeymen sanitarians in State governments averaged $10,000 annually; annual salaries were about $1,000 higher for sanitarians working for local governments. Salaries of supervisory sanitarians and sanitarians having extensive experience ranged to more than $20,000.

Sanitarians employed by the Federal Government started at $7,319 or $9,053 in 1972, depending on their academic records. Experienced sanitarians in the Federal service earned from $11,046 to $20,627.

Sanitarians spend considerable time away from their desks. Some come in contact with unpleasant physical surroundings, such as sewage disposal facilities and slum housing. Transportation or gasoline allowance frequently are given, and some health departments provide an automobile.

Sources of Additional Information

Information about careers as sanitarians is available from the following associations:

American Public Health Association, 1015 18th St. NW., Washington, D.C. 20036.

International Association of Milk, Food, and Environmental Sanitarians, Blue Ridge Rd., P.O. Box 437, Shelbyville, Ind. 46176.

National Environmental Health Association, 1600 Pennsylvania St., Denver, Colorado 80203.

Information on stipends for graduate study is available from:

Division of Allied Health Manpower, Bureau of Health Professions Education and Manpower Training, National Institute of Health, 9000 Rockville Pike, Bethesda, Md. 20014.

SOCIAL SCIENTISTS

The social sciences are concerned with all aspects of human society from the origins of man to the latest election returns. Social scientists, however, generally specialize in one major field of human relationships. Anthropologists study primitive tribes, reconstruct civilizations of the past, and analyze the cultures and languages of all peoples, past and present. Economists study the allocation of land, labor, and capital. Geographers study the distribution of people, throughout the world, types of land and water masses, and natural resources. Historians describe and interpret the people and events of the past and present. Political scientists study the theories, objectives, and organizations of all types of government. Sociologists analyze the behavior and relationships of groups—such as the family, the community, and minorities—to the individual or to society as a whole. Besides these basic social science occupations, a number of closely related fields are covered in separate statements elsewhere in this *Handbook*. (See statements on Statisticians, Psychologists, and Social Workers.)

The basic social science occupations provided employment for about 95,000 persons in 1972; about 10 percent of them were women. Overlapping among the basic social science fields and the sometimes hazy distinction between these and related fields such as business administration, foreign service work, and high school teaching, make it difficult to determine the exact size of each profession. Economists, however, are the largest social science group, and anthropologists the smallest.

Most social scientists work in colleges and universities. A large number work for the Federal Government and private industry. The trend in some industries is to hire increasing numbers of social science majors as trainees for administrative and executive positions. Research councils and other nonprofit organizations provide an important source of employment for economists, political scientists, and sociologists.

Overall employment in the social sciences is expected to grow moderately through the mid-1980's. Teaching in colleges and universities will remain the major area of employment. Employment of social scientists in government, private industry, and nonprofit organizations is expected to rise also. Despite this anticipated growth, the number of persons seeking to enter the social science field is likely to exceed available job openings. The following statements present more detailed information about the prospective outlook in the individual occupations.

ANTHROPOLOGISTS

(D.O.T. 055.088)

Nature of the Work

Anthropologists study man—his origins, physical characteristics, and culture. These areas include a study of the people's traditions, beliefs, customs, languages, material possessions, social relationships, and value systems. Although anthropologists generally specialize in one of these areas, they are expected to have a general knowledge of all of them.

Most anthropologists specialize in cultural anthropology, sometimes called ethnology. *Ethnologists* may spend long periods living with tribal groups or in other communities to learn about their ways of life. The ethnologist takes detailed and comprehensive notes that describe the social customs, beliefs, and material possessions of the people. He usually learns the native language in the process. He also makes comparative studies of the cultures and societies of various groups. In recent years, such investigations have included complex urban societies.

Archeologists excavate places where people of past civilizations lived. They study the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity to reconstruct the inhabitants' history and customs. For example, archeologists are digging in the Pacific Coast area between northern Mexico and Ecuador to find evidences of trade and migration in the pre-Christian Era. Some archeologists are excavating ancient Mayan cities in Mexico and restoring temples. Others are working in the Missouri River valley to salvage remnants of Indian villages and sites of early military forts and trading posts.

Some anthropologists specialize in

linguistics, the scientific study of the sounds and structures of languages and of the historical relationships among languages. They study the relationship between the language and the behavior of people. Their work assists in reconstructing the prehistory of mankind.

Physical anthropologists study human evolution. They do comparative studies of the physical characteristics of different races or groups of people as influenced by heredity and environment. In order to perform these tasks, physical anthropologists need extensive training in human anatomy and biology. Because of their knowledge of body structure, physical anthropologists occasionally are employed as consultants on projects such as the design of driver seats, space suits, cockpits for airplanes and spaceships, and the sizing of clothing. They consult on projects to improve environmental conditions and on criminal cases. They are increasingly employed in medical schools.

Closely related to the four basic subfields is *applied anthropology*, an emerging specialty which attempts to use the findings in the other anthropological areas in a practical manner. Applied anthropologists may, for example, provide technical guidelines to ease the transition of nonindustrial societies to a more complex level of socioeconomic organization. Another related specialty area is *urban anthropology*, which is the study of urban life, urbanization, rural-urban migration, and the influence of city life.

Most anthropologists teach in colleges and universities. They often combine teaching with research. Some anthropologists specialize in museum work, which generally combines managerial and administrative duties with field work and research on anthropological collections. A few work as consultants or engage in nontechnical writing, or other activities.

Places of Employment

About 3,700 persons—about one-fifth of them women—worked as anthropologists in 1972. About four-fifths of all anthropologists work in colleges and universities. Several hundred work in private industry and nonprofit organizations. The Federal Government employs a small number, chiefly in museums, national parks, in the Bureau of Indian Affairs, and in technical aid programs. State and local government agencies also employ some anthropologists, usually for museum work or health research.

Training, Other Qualifications, and Advancement

Students who want to become anthropologists should get the Ph.D. degree. College graduates with bachelor's degrees often get tempo-

rary positions and assistantships in the graduate departments where they are working for advanced degrees. A master's degree, plus field experience, is sufficient for many beginning professional positions, but promotion to top positions is generally reserved for individuals who have a Ph.D. degree. Anthropologists in many colleges and most universities need a Ph.D. degree to get permanent teaching appointments.

Some training in archeology, linguistics, and physical and cultural anthropology is necessary for all anthropologists. Mathematics is helpful, since statistical and computer methods are becoming more widely used for research in this field. Undergraduate students may begin their field training in archeology by arranging, through their university departments, to accompany expeditions as laborers or to attend field schools established for training. They may later advance to supervisor in charge of the digging or collection of material and finally may direct a portion of the work of the expedition. Ethnologists and linguists usually work independently in doing their field work. Most anthropologists base their doctoral dissertations on data collected through field research; they are, therefore, experienced fieldworkers by the time they earn the Ph.D. degree.

About 200 colleges and universities have bachelor degree programs in anthropology; nearly 130 offer master's degree programs and about 80, doctorate programs. Most universities that have graduate programs also offer undergraduate training in anthropology. The choice of a graduate school is very important. Students interested in museum work should select a school that can provide experience in an associated museum that has anthropological collections. Similarly, those interested in archeology should either choose a university that offers opportunities for summer experience in archeological fieldwork, or else should plan to attend an archeological field school elsewhere during their summer vacations.

Anthropologists should be persons who have an above average interest in natural history or social studies and enjoy reading, research, and writing. A desire to travel and the ability to cope with the disadvantages of remote work areas are sometimes necessary for success.

Anthropologists work with ideas and have the opportunity for self-expression. They should have the ability to work with detail and work independently.

Employment Outlook

Employment in this rather small occupation is expected to increase very rapidly through the mid-1980's. The largest area of employment will continue to be in college and university teaching. However, an increasing number of jobs will be available for anthropologists in museums, and in programs of archeological research, mental and public health, and poverty and community action, as well as in private industry.

The number of graduates with advanced degrees in anthropology also is expected to grow very rapidly, and it is very likely that the number seeking to enter the field will exceed job openings generated by growth as well as replacement needs. As a result, anthropologists holding the doctorate may face keen competition for positions of their choice through the mid-1980's. Graduates with only the master's degree are expected to face very persistent competition for professional positions in anthropology and may have to enter related fields of work such as mental health or poverty programs. Some who meet certification requirements may secure high school teaching positions. Others may find jobs in government, and in nonprofit organizations and civic groups that hire personnel with social science training as a general background.

Earnings and Working Conditions

Starting salaries for anthropologists with a Ph.D. degree were generally about $12,000 a year in 1972. Experienced anthropologists earned median salaries of $16,000 a year, according to limited data available. They may, however, earn more than $20,000 a year.

In the Federal Government, starting salaries for anthropologists having a master's degree were $11,614 a year in early 1973, and for those having a Ph.D., $13,996. Experienced anthropologists earned from $16,700 to more than $23,000 a year.

Many anthropologists who work in colleges and universities supplement their regular salaries with earnings from other sources such as summer teaching and research grants.

Anthropologists doing archeological fieldwork sometimes are required to work in adverse weather conditions and perform manual labor. They also must adapt themselves to cultural environments which are materially and socially different.

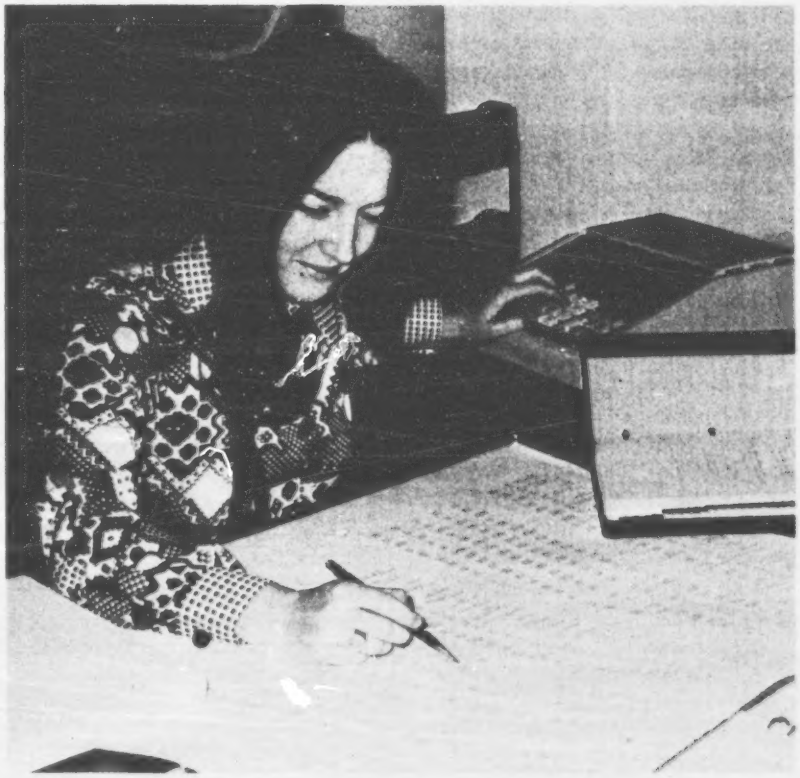
Sources of Additional Information

For information about employment opportunities and schools that offer graduate training in anthropology, contact:

The American Anthropological Association, 1703 New Hampshire Ave. NW., Washington, D.C. 20009.

ECONOMISTS

(D.O.T. 050.088)



Economist analyzes results of computer printout.

Nature of the Work

Economics is concerned with how to utilize scarce resources to provide goods and services for society. Economists study the problems that arise in the use of such resources as land, raw materials, and manpower. Economists analyze the relationship between the supply of goods and services and demand for them, on the one hand, and on the other, how goods and services are produced, distributed, and consumed. Some economists are concerned with such practical matters as the control of inflation, business cycles, and unemployment, as well as farm, wage, tax, and tariff policies. Others develop theories to explain the causes of employment and unemployment or the ways in which international trade influences world economic conditions. Still others collect, analyze, and interpret data on a wide variety of economics problems.

Economists who work in colleges and universities teach the theories, principles, and methods of economics and conduct or direct research. They frequently write, and act as consultants.

Economists in government plan and carry out studies used to assess economic conditions and the need for changes in government policy. To accomplish this work they collect data, analyze it, and prepare reports. Most government economists are in the fields of agriculture, business, finance, labor, or international trade and development.

Economists who work for business firms provide management with information to make decisions on marketing and pricing of company products; the effect of government policies on business or international trade; or the advisability of adding new lines or merchandise, opening new branch operations, or otherwise expanding the company's business.

Places of Employment

Economics is the largest social science field. More than 36,000 persons, about 6 percent of them women, worked as economists in 1972. Private industry and business employ one-half; colleges and universities about one-third; and government agencies—mainly Federal—roughly one-sixth. A few are self-employed or work for private research organizations.

Economists work in all large cities and university towns. The largest number are in the New York City and the Washington, D.C. metropolitan areas. Some work overseas, mainly for the U.S. Department of State and the Agency for International Development.

Training, Other Qualifications, and Advancement

Economists must have a thorough understanding of economic theory and methods of economic analysis. An increasing number of universities emphasize the value of mathematical methods of economic analysis. Since many beginning jobs for economists in government and business involve the collection and compilation of data, a thorough knowledge of basic statistical procedures usually is required.

A bachelor's degree with a major in economics is sufficient for many

beginning research jobs in government and private industry, although persons employed in these entry jobs are not usually regarded as professional economists. In the Federal Government, candidates for entrance positions must have a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus.

Graduate training is very important for persons who want to become economists. Students interested in research should select schools that emphasize training in research methods and statistics and provide good research facilities. Those who wish to work in agricultural economics will find opportunities to gain experience in part-time research work at State universities that have agricultural experiment stations.

A master's degree generally is required to get a job as a college instructor, although in large schools graduate assistantships sometimes are awarded to superior students working toward their master's degrees. In many large colleges and universities, completion of all the requirements for a Ph.D. degree, except the dissertation, is necessary for appointment as instructor. In government or private industry, economists who have a master's degree usually can qualify for more responsible research positions.

The Ph.D. degree is required for a professorship in a high-ranking college or university and is an asset when competing for other responsible positions in government, business, or private research organizations.

About 800 colleges and universities offer bachelor degree programs in economics, 200 master's, and 100 doctorate.

Persons who consider careers as economists should be able to work accurately and in detail—since much time is spent on research. Frequently, the ability to work as part of a team is required. Economists must be objective in their work and be able to express themselves effectively orally or in writing, since they do many reports and presentations.

Employment Outlook

The number of persons who will graduate with degrees in economics through the mid-1980's is likely to exceed available positions that will arise from the expected moderate growth of the occupation and the need to replace economists who will die and retire during this period. As a result well-trained economists having a doctorate or master's degree are expected to face keen competition for choice academic positions. Persons who have bachelor's degrees in economics may find some employment in government, industry and business as trainees or management interns, but competition may be keen.

Private industry and business will continue to provide the largest number of employment opportunities for economists because of increased reliance on scientific methods of analyzing business trends, forecasting sales and planning purchases and production operations. The next largest area of employment opportunities for economists will be in colleges and universities where a projected moderate increase in enrollments will lead to a similar increase in faculty size. Employment of economists in State and local government agencies is expected to increase rapidly because of the increasingly analytical nature of programs in areas such as housing and poverty. Employment of economists in the Federal Government is expected to rise slowly—in line with the rate of growth projected for the Federal work force as a whole.

Earnings

Starting salaries for economists with a Ph.D. were nearly $12,000 a year in 1972, according to limited information. Salaries of economists employed by colleges and universities in 1972 averaged about $20,000, and for those in business, industry, and nonprofit organizations it was about $22,000. Economists who have a Ph.D. are paid higher salaries than those who have lesser degrees and similar experience. A substantial number of economists supplement their basic salaries by consulting, teaching, and other research activities. Economists earn about twice as much as the average earnings for non-supervisory workers in private industry or private nonfarm payrolls.

In the Federal Government, the entrance salary for beginning economists having a bachelor's degree was $7,694 a year in 1973; however, those with superior academic records could begin at $9,520. Those having 2 full years of graduate training or experience could qualify for positions at an annual salary of $11,614. Most experienced economists in the Federal Government earned from $17,000 to $23,000 a year; some having greater administrative responsibilities earned considerably more.

Sources of Additional Information

Additional information on a career as an economist is available from:

American Economic Association, 1313 21st Avenue South, Nashville, Tenn. 37212.

HISTORIANS

(D.O.T. 052.088)

Nature of the Work

History is the record of past events, institutions, ideas, and people. Historians describe and analyze the past through writing, teaching, and research. They relate their knowledge of the past to current events in an effort to explain the present.

Historians may specialize in the history of a specific country or area, or in a particular period of time—ancient, medieval, or modern. They may specialize, also in the history of a field, such as economics, culture, military affairs, the labor movement, art, or architecture. The number of specialties in history is constantly growing. Newer specialties are concerned with business archives, quantitative analysis, and the relationship between technological and other aspects of historical development. In this country, most historians still specialize in the political history of either the United States or modern Europe; however, a growing number now specialize in African, Latin American, Asian, or Near Eastern history. Some historians specialize in phases of a larger historical field. They may for example, study part of American history such as the Civil War.

Most historians are college teachers who not only lecture, but write and take part in research. Some are specialists called *archivists*, who identify or prepare exhibits, or who are spokesmen for museums, special libraries, and historical societies. A few serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Some historians are researchers or administrators in government. They prepare studies, articles, and books on their research findings.

Historian searches for information at National Archives.

Places of Employment

About 24,000 people worked as professional historians in 1972. More than 10 perce[illegible] were women. Colleges and universities employ about three-fifths of all historians. Historians also work in archives, libraries, museums, junior colleges, secondary schools, research and editing organizations, and government. Historians employed in the Federal government work principally in the National Archives, and the Departments of Defense, Interior, and State. A small growing number work for State and local governments.

Since history is taught in all U.S. institutions of higher education, historians are found in college communities. Many of the historians in the Federal Government are employed in Washington, D.C. Historians in other types of employment usually work in localities that have museums or libraries with collections adequate for historical research.

Training, Other Qualifications, and Advancement

Graduate education usually is necessary for employment as an historian. A master's degree in history is the minimum requirement for the position of college instructor. In many colleges and universities, however, a Ph.D. degree is essential for high-level teaching, research, and administrative positions. Most historians in the Federal Government and in nonprofit organizations have Ph.D. degrees, or their equivalent, in training and experience.

Although a bachelor's degree and a major in history is sufficient training for some beginning jobs in government—either Federal, State, or local—people in such jobs may not be regarded as professional historians. A knowledge of archival work is helpful, since beginning jobs are likely to be concerned with collection and preservation of historical data. For some jobs in international relations and journalism an undergraduate major in history is considered helpful.

Training for historians is available in many colleges and universities. Over 1,300 schools offer programs for the bachelor's degree, about 550 offered the master's and 115 offered doctorates.

History curriculums in the nation's colleges and universities are varied; however, each basically provides, in addition to history topics, training in research methods, writing, and speaking. These are the basic skills essential for historians in all positions in this field. Quantitative methods of analysis are becoming more important for historians and many college programs include them.

Historians spend a great deal of time studying, doing research, writing papers and reports, and giving lectures and presentations. In order to do these things well, they must be capable of communicating their ideas effectively, orally and in writing. The ability to work as part of a group, as well as independently is essential.

Employment Outlook

Employment of historians is expected to grow moderately through the mid-1980's. Historians will be needed to fill positions in colleges and universities, junior colleges, libraries, archives, museums, secondary schools, research and editorial organizations, and government. Demand also will exist for people with training in historical specialties such as business history, as well as those who use quantitative methods in their research. In addition to jobs created by growth of the field, an even larger number of openings for historians each year over the projected period is expected to result from the need to replace those who retire, die, or leave the profession.

In contrast with the projected moderate growth of the occupation is a probable continuing rapid increase in the number of persons graduating with master's and doctoral degrees in history. Not all who receive advanced degrees in history, of course, represent new entrants to the profession. Although information is limited on patterns of entry to the field, if present trends in the number of persons studying for advanced degrees in history continue, the number of persons seeking to enter the field will likely exceed available positions. As a result, historians who have a Ph.D. are expected to face keen competition for the more desirable positions through the mid-1980's, especially for jobs in the academic community. Historians having only the master's degree will encounter very keen competition for jobs, but some teaching positions may be available in junior colleges or some high schools if they meet state certification requirements. People having only a bachelor's degree in history may be able to qualify as administrative and management trainees in government agencies, foundations, civic organizations, and private industry.

Earnings

Starting salaries for historians having a doctorate averaged nearly $12,000 a year in 1972, according to limited information; master's degree holders have average starting salaries of nearly $10,000 a year. Salaries of historians in educational institutions averaged $16,500 in 1972; in State and local governments, $13,000; in nonprofit organizations, about $16,000; and in private industry, nearly $18,000 a year. The annual median salary for historians was more than $14,000 in 1972. Historians earn about twice as much as the average earnings for nonsupervisory workers in private industry or private nonfarm payrolls.

In the Federal Government, the starting salary for people having a bachelor's degree in history was $7,694 in early 1973. Those who had a superior academic record or a year of graduate training were eligible to start at $9,520. Experienced historians employed by the Federal Government in early 1973 earned between $13,996 and $26,898.

Some historians, particularly those in college teaching, supplement their income by summer teaching or writing books or articles. A few earn additional income from lectures.

Sources of Additional Information

Additional information on employment opportunities for historians is available from:

American Historical Association, 400 A St. SE., Washington, D.C. 20003.

GEOGRAPHERS

(D.O.T. 029.088 and 059.088)

Nature of the Work

Geographers study the spatial characteristics of the earth's terrain, minerals, soils, water, vegetation, and climate. They relate these char-

acteristics to changing patterns of human settlement—where people live, why they are located there, and how they earn a living.

The majority of geographers are college or university teachers; some combine teaching and research. Their research includes the study and analysis of the distribution of land forms, climate, soils, vegetation, and mineral and water resources. They also analyze the distribution and structure of political organizations, transportation systems, marketing systems, and urban systems. Many geographers spend considerable time in field study, and in analysing maps, aerial photographs, and observational data collected in the field. Sometimes they utilize surveying and meteorological instruments. Photographs and other data from remote sensors on satellites are used increasingly. Other geographers construct maps, graphs, and diagrams.

Most geographers specialize in one branch or more of geography. *Economic geographers* deal with the geographic distribution of economic activities—including manufacturing, mining, farming, trade, and communications. *Political geographers* study how political processes affect geographic boundaries on subnational, national, and international scales and the relationship of spatial processes (geographic conditions) to political processes. *Urban geographers* study cities and their problems in depth, and are concerned with city and community planning. (See statement on Urban Planners elsewhere in the *Handbook*.) *Physical geographers* study the physical characteristics of the earth and moon. *Regional geographers* study the physical, economic, political, and cultural characteristics of a particular region or area, which may range in size from a river basin or an island, to a State, a country, or even a continent. *Cartographers* compile data and design and construct maps.

Many geographers have job titles such as cartographer, map cataloger, or regional analyst, that describe their specialization. Others have titles that relate to the subject matter of their study such as photo-intelligence specialist or climatological analyst. Still others have titles such as community or environmental planner, or market or business analyst. Most of those who teach in colleges and universities are called geographers.

Places of Employment

About 7,500 persons worked as geographers in 1972; about 15 percent were women.

Colleges and universities employ more than two-thirds of all geographers. The Federal Government employs a large number. Among Federal agencies, the Department of Defense employs the largest number in such agencies as the Defense Mapping Agency, the Aeronautical Chart and Information Center, Naval Intelligence. The Commerce Department employs geographers in such agencies as the Coast and Geodetic Survey, Bureau of the Census, Office of Regional Commissions, National Oceanic and Atmospheric Administration and National Weather Service. Geographers employed by the Interior Department work in such agencies as Bureau of Indian Affairs, Bureau of Outdoor Recreation, Bureau of Land Management and Geological Survey. Other government agencies that employ geographers include the Central Intelligence Agency (CIA), Office of Emergency Planning, National Aeronautical and Space Administration (NASA), and the Library of Congress.

Training, Other Qualifications, and Advancement

The educational requirement for beginning positions in geography is usually a bachelor's degree with a major in the field. For research and teaching jobs, and for advancement, graduate training is usually required. A Ph.D. is preferred.

In the Federal Government, candidates for entrance positions must have a minimum of 15 semester hours in geography and 9 hours in related fields such as statistics or economics. For an applicant to start at a higher level, he needs 30 hours in geography and related fields and a year of graduate study or work experience as a geographer.

About 380 colleges and universities offered degree training in geography in 1972. Undergraduate study provides a general introduction to geographic knowledge and research methods and often includes some field studies. Typical courses offered are physical and cultural geography, weather and climate, economic geography, political geography, urban geography, weather and climate, quantitative methods in geography, and comparative courses such as the geography of North

America and the USSR. Courses in cartography and in the interpretation of maps and aerial and satellite photographs also are offered.

State and local governments also employ small numbers of geographers, mostly on city and State planning and development commissions.

A small but growing number of geographers work in private industry. Most work for marketing research organizations, textbook and map publishers, travel agencies, manufacturing firms or chain stores. A few work for scientific foundations and research institutes.

In 1972, 115 institutions offered master's degree programs; 50 offered Ph.D. programs. Admittance to a graduate program usually requires a bachelor's degree with a major in geography. However, many universities admit students with bachelor's degrees in any of the social or physical sciences with some background in geography. Requirements for advanced degrees include field and laboratory work as well as advanced classroom studies in geography and thesis preparation. Many graduate schools also require course work in advanced mathematics and computer science because of the increasing emphasis on these areas in the field. A language is required for those students who plan to enter the field of foreign regional geography.

Persons who want to become geographers should enjoy reading, studying, and research because they must keep abreast of developments in the field. Geographers must work with abstract ideas and theories as well as do practical studies. They also must be able to work independently and communicate their ideas orally and in writing.

Employment Outlook

The employment outlook for geographers with the Ph.D. is expected to be favorable through the mid-1980's for positions in research and teaching in college and universities and for research jobs in industry and government. Those with the master's degree are likely to face some competition for choice academic positions; however, expanding geography programs in junior colleges should provide some jobs. Colleges and universities will continue to provide the largest number of employment opportunities for geographers because of the expected increase in college enrollment through the mid-1980's. Some other jobs should be available in research for government or private industry.

Graduates who have only the bachelor's degree in geography usually are not qualified for jobs as professional geographers. However, they may find positions connected with making, interpreting, or analyzing maps; or in research, either working for the government or industry. Others enter beginning positions in the planning field. Some may obtain employment as research or teaching assistants in educational institutions while studying for advance degrees. Some bachelor's degree holders do teach at the high school level. Some earn library science degrees and become map librarians.

Employment of geographers in government is expected to increase. The Federal Government will need additional personnel to work in programs such as regional development, environmental quality, and intelligence. Employment of geographers in State and local governments also is expected to expand, particularly in areas such as conservation, environmental quality control, highway planning, and city, community, and regional planning and development. Private industry also is expected to employ increasing numbers of geographers for market research and location analysis.

Earnings

Salaries of geographers in colleges and universities depend on their teaching rank and experience. Assistant professors entering the field with a Ph.D. and no experience started at between $10,500 and $11,000 in 1972, according to limited information. Nearly three-fourths of all geographers earned between $10,000 and $20,000 a year, according to a recent survey conducted by the Association of American Geographers. About one-fourth earned between $20,000 and $25,000, and a few more than $25,000, in an academic year (9 months). (See statement on College and University Teachers elsewhere in the *Handbook*.) Geographers in educational institutions usually have an opportunity to earn income from other sources, such as consulting work, special research, and publication of books and articles.

Geographers in the Federal Government with the bachelor's degree and no experience started at $7,694 or $9,520 a year in early 1973, depending on their college records. Those with 1 or 2 years of graduate work started at $9,520 or $11,614 a year, and those with the Ph.D. at $13,996.

Geographers earn about twice as much as the average earnings for non-supervisory workers in private industry, except farming.

Sources of Additional Information

Additional information on a career as a geographer is available from:

Association of American Geographers, 1710 16th St. NW., Washington, D.C. 20009.

POLITICAL SCIENTISTS

(D.O.T. 051.088)

Nature of the Work

Political scientists study governments—what they are, what they do, and how and why. Many of them specialize in a general area of political science including political theory, U.S. political institutions and processes, comparative political institutions and processes, or international relations and organizations. Some specialize in a particular type of political institution or in the politics of a specific era.

Most political scientists are college and university teachers. They combine research, consultation, or administrative duties with teaching. Some are primarily researchers who survey public opinion on political questions for private research organizations, or study proposed legislation for Federal, State, and municipal governments, legislative reference bureaus or congressional committees. Others analyze the operations of government agencies or specialize in foreign affairs, research, either for government or nongovernment organizations. Some administer government programs.

Places of Employment

About 10,000 people worked as political scientists in 1972; ten percent were women. About four-fifths work in colleges and universities. Most of the remainder work in government, research bureaus, civic and tax payers associations, and large business firms.

Political scientists can be found in nearly every college or university town since courses in government and political science are taught in almost all higher education curriculums. Some work overseas primarily for agencies of the U.S. Department of State, such as the Foreign Service, and the U.S. Agency for International Development. They also work for the U.S. Information Agency.

Training and Other Qualifications

Graduate training generally is required for employment as a political scientist. Completion of the requirements for the Ph.D. degree, except the doctoral dissertation, is the usual prerequisite for appointment as a college instructor. A Ph.D. degree is required for advancement to the position of assistant professor. The Ph.D. also is helpful for advancement in nonacademic areas.

College graduates having a master's degree can qualify for various administrative and research positions in government and in nonprofit research or civic organizations. A master's degree in international relations, foreign service, and area study (for example, New England, government) is helpful in obtaining positions in Federal Government agencies concerned with foreign affairs.

People with only a bachelor's degree in political science may qualify as trainees in public relations, research, budget analysis, personnel, or investigation fields. Many students with bachelor's degrees in political science go on to study law or some specialized or related branch of political science, such as public administration and international relations.

In 1972, more than 1,300 colleges and universities offered a bachelor's degree in political science, 268 had master's programs, and 115 had doctoral programs. Many colleges and universities offer field training and internships to gain experience in government work.

Undergraduate programs in political science vary throughout the Nation. A typical undergraduate curriculum in political science includes introductory politics, state and urban politics, comparative studies, political theory, foreign policy and public administration. An increasing number include courses in quantitative and statistical methods because of increased research emphasis in the field.

Political scientist discussing Government operations with colleague.

People planning careers as political scientists should like to work with details. They must be objective and able to work independently or as part of a team. Ability to express themselves clearly, orally and in writing, is important to political scientists, as they must communicate the results of their findings.

Employment Outlook

The number of persons who will graduate with advanced degrees in political science is likely to exceed available job openings. Those having a Ph.D. may face stiff competition finding choice academic positions. Master's degree holders are

not likely to find positions as college and university instructors, but those having specialized training in areas such as policy analysis or public administration should have some opportunities in Federal, State and local government, research bureaus, political organizations and welfare agencies. New graduates having only the bachelor's degree are expected to find very limited opportunities. However, for those planning to continue their studies in law, foreign affairs, journalism, and other related fields, a political science background is very helpful. Some who meet State certification requirements will be able to enter high school teaching.

Employment of political scientists is expected to increase moderately through the mid-1980's. The largest area of employment will continue to be in college and university teaching. In addition to those required to staff new positions, political scientists will be needed to fill positions vacated due to retirements, death or transfers.

Earnings

Beginning political scientists with a master's degree earned about $9,000 a year in 1972 according to limited information; with doctoral degrees, about $10,500.

According to limited information, the median salary of those who work in educational institutions was $13,000 for an academic year, and $16,800 for a calender year. Political scientists in the Federal government averaged $20,000 a year, and those in state and local government about $17,000. Those employed in nonprofit organizations and private industry and business had a median salary of more than $19,000. Political scientists earn about twice as much as the average earnings for non-supervisory workers in private industry or private nonfarm payrolls.

In the Federal Government, the starting salary for political scientists having a bachelor's degree was about $7,694 a year in early 1973. Those having a superior academic record or a year of graduate training were eligible to start at $9,520.

Some political scientists, particularly those in college teaching, supplement their income by teaching summer courses or consulting.

Sources of Additional Information

Additional information on employment opportunities in political science and public administration is available from:

American Political Science Association, 1527 New Hampshire Ave. NW., Washington, D.C. 20036.

SOCIOLOGISTS

(D.O.T. 054.088)

Nature of the Work

Sociologists study the groups that man forms in his association with others. These groups include families, tribes, communities, and governments, along with a variety of social, religious, political, business, and other organizations. They study the behavior and interaction of these groups; trace their origin and growth; and analyze the influence of group activities on individual members.

Some sociologists concern themselves primarily with the characteristics of social groups and institutions. Others are more interested in the ways individuals are affected by groups to which they belong.

Many sociologists specialize in social organization, social psychology, or rural sociology. Others specialize in intergroup relations, family problems, social effects of urban living, population studies, or analyses of public opinion. Some conduct surveys or concentrate on research methods. Growing numbers apply sociological knowledge and methods in penology and correction, education, public relations in industry, and regional and community planning. A few specialize in medical sociology—the study of social factors that affect mental and public health.

Most sociologists are college and university teachers whose duties include both teaching and research. Sociological research involves the collection of information, preparation of case studies, testing, and the conduct of statistical surveys and laboratory experiments.

Sociologists also supervise research projects or the operation of social agencies such as family and marriage clinics. Others, acting as consultants, advise on diverse problems such as the management of hospitals for the mentally ill, the rehabilitation of juvenile delinquents, or

Sociologist working on manuscript for publication.

the development of effective advertising programs to promote public interest in particular products such as television sets or cars.

Places of Employment

About 15,000 persons worked as sociologists in 1972, more than one-seventh were women. Others work in positions that require training in this field but are not classified as professional sociologists. These fields include social, recreation, and public health work.

Colleges and universities employ about four-fifths of all sociologists. The remainder work for Federal, State, local, or international government agencies, in private industry, or in welfare or other nonprofit organizations, or else are self-employed.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. They are most heavily concentrated, however, in large colleges and universities which offer graduate training in sociology and opportunities for research.

Training, Other Qualifications, and Advancement

A master's degree and a major in sociology usually is the minimum requirement for employment as sociologist. The Ph.D. degree is an essential for attaining a professorship in most colleges or universities. It also is commonly required for directors of major research projects, important administrative positions, or consultants.

Sociologists having master's degrees, who are trained in research and statistical and computer methods can qualify for many administrative and research positions. Advancement to supervisory positions in both public and private agencies is gained through experience. Sociologists having a master's degree qualify for some college instructorships. Most colleges, however, appoint as instructors only people who have training beyond the master's level—frequently the completion of all requirements for the Ph.D. degree except the doctoral dissertation. Outstanding graduate students often get teaching or research assistantships which provide both financial aid and valuable experience.

Bachelor's degree holders in sociology usually are not recognized by the profession as sociologists. However, they may, get jobs as interviewers or as research assistants. Many work as caseworkers, counselors, recreation workers, or administrative assistants in public and private welfare agencies. Sociology majors who have sufficient training in statistics may get positions as beginning statisticians. Those who meet State certification requirements can teach high school. About 900 colleges and universities offer bachelor degree programs; more than 200 offer master's degrees, and nearly 120 have doctorate programs.

The choice of a graduate school is important for people who want to become sociologists. Students interested in research should select schools that emphasize training in research, statistical, and computer methods. Opportunities to gain practical experience in research work may be available also. Professors and chairmen of sociology departments frequently aid in the placement of graduates.

Sociologists spend a great deal of their time in study and research. They must be able to communicate effectively, both orally and in writing, their ideas and findings. The ability to work as part of a group or independently is important.

Employment Outlook

Overall employment opportunities for sociologists who have a Ph.D. are expected to be favorable through the mid-1980's. However, those seeking choice academic positions may face some competition. Those having only a master's degree will probably continue to face considerable competition for academic positions, but some jobs will be available in government and private industry. Sociologists well trained in research methods, advanced statistics and use of computer, will have the widest choice of jobs. Demand is expected to be strong for research personnel to work in the areas of rural sociology, community development, population analysis, public opinion research, medical sociology, and juvenile delinquency and education.

Employment of sociologists is expected to increase very rapidly through the mid-1980's. Most new positions will continue to be in college teaching. Some of these openings will result from the growing trend to include sociology courses in the curriculums of other professions, such as medicine, law, and education. Demand in the nonteaching area will center around public and private programs dealing with the development of human resources, particularly those designed to cope with social and welfare problems. In addition to growth needs, several hundred openings will occur each year to replace sociologists who die, retire, or leave the field for other reasons.

Earnings

In 1972, according to limited information, the average salary for sociologists was more than $14,000 a year. Sociologists working in educational institutions on a calendar year basis averaged about $16,500. Salaries ranged from $11,500 for an assistant professor to $36,000 for some heads of departments. Sociol-

ogists working in nonprofit organizations and private industry had average annual salaries of $16,000 and $18,000 respectively. Sociologists earn about twice as much as the average earnings for nonsupervisory workers in private industry or on private nonfarm payrolls.

In the Federal Government, the beginning salary for sociologists having a master's degree and a superior academic record was $11,614 a year in early 1973. Salaries of experienced sociologists in the Federal Government generally ranged between $13,996 and $26,898 a year.

In general, sociologists having the Ph.D. degree earn substantially higher salaries than those having master's degrees. Many sociologists, particularly those employed by colleges and universities for the academic year (September to June), are likely to supplement their regular salaries with earnings from other sources, such as summer teaching and consulting work.

Sources of Additional Information

Additional information on sociologists is available from:

The American Sociological Association, 1722 N St., NW., Washington, D.C. 20036.

SOCIAL SERVICE OCCUPATIONS

Workers in social service occupations help people adjust to problems in their daily lives. Depending on their specific occupation, they may advise consumers on how to get the most for their money; help handicapped people to achieve satisfactory lifestyles; counsel people with problems in their job, home, school, or social relationships; or treat people with moderate and severe psychological problems.

A genuine concern for all kinds of people is necessary for anyone considering a career in a social service occupation. Patience, tact, sensitivity, and a sense of humor along with compassion for others balanced with objectivity, are helpful personal qualities.

COUNSELING OCCUPATIONS

Professional counselors help people to understand themselves and their opportunities so that they can make and carry out decisions and plans for a satisfying and productive life. Whatever the area of counseling—personal, educational, or vocational—counselors must combine objectivity with genuine concern for each client. They must believe in the uniqueness and worth of each individual, in his right to make and accept responsibility for his own decisions, and in his potential for development.

This chapter covers four generally recognized specialties in the field: school counseling; rehabilitation counseling; employment counseling; and college career planning and placement counseling.

School Counselors are the largest counseling group. Their main concern is the personal and social development of students and helping them plan and achieve their educational and vocational goals.

Rehabilitation Counselors work with persons who are physically, mentally, or socially handicapped. Their counseling is generally job-oriented, but also involves personal counseling.

Employment Counselors are mainly concerned with career planning and adjustment of young, old, able-bodied, and disabled persons.

College Career Planning and Placement Counselors help college students examine their own interests, abilities, and goals; explore career alternatives; and make and follow through with a career choice.

Persons who want to enter the counseling field must be interested in helping people and have an ability to understand their behavior. A pleasant but strong personality that instills confidence in clients is desirable in counselors. They also must be patient, sensitive to the needs of others, and able to communicate orally as well as in writing.

Many psychologists, social workers, and college student personnel workers also do counseling. The occupation most closely related to counselor is that of the counseling psychologist. Other professional workers who do some counseling but primarily work in teaching, health, law, religion, personnel, or other fields, are described elsewhere in the *Handbook*.

SCHOOL COUNSELORS

(D.O.T. 045.108)

Nature of the Work

School counselors are concerned about the educational, career, and social development of students. They work with students, both individually and in groups, as well as with teachers, other school personnel, parents, and community agencies.

Counselors use the results of interest, achievement, and intelligence tests as well as school and other records to help students evaluate themselves. Then, with each student and sometimes with the parents, they help develop an educational plan that fits the student's abilities, interests, and career aspirations.

Many high school counselors help students individually with personal and social problems. They also may lead group counseling sessions and discussion groups on topics related to student interests and problems.

School counselors often maintain a small library containing occupational literature so that students may find descriptions of work that they have heard about or in which they have shown an interest. Information on training requirements, earnings and employment outlook often are included with these job descriptions. Computers that students can operate are being experimented with in this area.

Counselors sometimes arrange trips to factories and business firms, and show vocational films to provide a view of real work settings. To bring the workplace into the school, the counselor may conduct "career day" programs.

School counselors must keep up-to-date on opportunities for educational and vocational training beyond high school to counsel students who want this information. They must keep informed about training programs in 2- and 4-year colleges; in trade, technical and business schools; apprenticeship programs; and available federally supported programs. Counselors also advise students about educational requirements for entry-level jobs, job changes caused by automation and other technological advances, college entrance requirements and places of employment.

Counselors in high schools often help students find part-time jobs, either to enable them to stay in school, or to help them prepare for their vocation. They may assist students leaving school before or after graduating to find jobs or may direct them to community employment services. They also may participate in follow-up studies of graduates and

dropouts, conduct surveys of local job opportunities, or determine the effectiveness of the educational and guidance programs.

Elementary school counselors help children to make the best use of their abilities by identifying these and other basic aspects of the child's makeup at an early age, and by evaluating any learning problems. Methods used in counseling grade school children differ in many ways from those used with older students. Observations of classroom and play activity furnish clues about children in the lower grades. To better understand children, elementary school counselors spend much time consulting with teachers and parents. They also work closely with other staff members of the school, including psychologists and social workers.

Some school counselors, particularly in secondary schools, teach classes in occupational information, social studies, or other subjects. They also may supervise school clubs or other extracurricular activities, often after regular school hours.

Places of Employment

About 43,000 people worked full-time as public school counselors during the 1971–72 school year. More than 10 percent of them worked in elementary schools.

Most counselors work in large schools. An increasing number of school districts, however, provide guidance services to their small schools by assigning more than one school to a counselor.

For the most part, counselors who work in junior high schools and especially in elementary schools are women; in high schools the majority of the counselors are men. However positions at both levels are equally available to men and women.

Training, Other Qualifications, and Advancement

Most States require school counselors to have counseling and teaching certificates. (See statements on Elementary and Secondary School Teachers for certificate requirements.) Depending on the State, graduate work and from 1 to 5 years of teaching experience usually are required for a counseling certificate. People who plan to become counselors should learn the requirements of the State in which they plan to work, since requirements vary among States and change rapidly.

College students interested in becoming school counselors usually take the regular program of teacher education, with additional courses in psychology and sociology. In States where teaching experience is not a requirement, it is possible to major in a liberal arts program. A few States substitute counseling internship for teaching experience. In some States, teachers who have completed part of the courses required for the master's degree are eligible for provisional certification and may work as counselors under supervision while they take additional courses.

Counselor education programs at the graduate level are available in more than 370 colleges and universities, most frequently in the departments of education or psychology. One to two years of graduate study are necessary for a master's degree. Most programs provide supervised field experience.

Subject areas of required graduate-level courses usually include appraisal of the individual student, individual counseling procedures, group guidance, information services for career development, professional relations and ethics, and statistics and research.

The ability to help others accept personal responsibility for their own lives is important for school counselors since they work with the development of young people. They must be able to coordinate the activity of others and work as part of the team which forms the educational system.

School counselors traditionally began as teachers and advanced to

principal. However, in recent years, the trend is either to remain a counselor, possibly moving to a larger school; to advance to become director or supervisor of counseling or guidance; or, with further graduate education, to advance to become a college counselor, educational psychologist, or school psychologist.

Employment Outlook

Employment opportunities for well-trained school counselors are expected to be favorable through the mid-1980's. Over the long run, demand for school counselors will be due in large part to the impact of the Federal Government's Career Education program. This program is designed to inform children about the world of work early in their education, so that by the time they leave the formal education system they are prepared for a suitable and available career. In addition to the expected expansion of the occupation, many counselors will be required each year to replace those who leave the profession.

Employment of school counselors is likely to grow only moderately through most of the remainder of the 1970's as the decline in school enrollments continues. An expected upswing in enrollments beginning in the late 1970's should stimulate a more rapid growth in counselor employment through the mid-1980's. In 1972, the average ratio of counselors to students as a whole was still well below generally accepted standards despite Federal aid to the States for support and expansion of counseling programs. Some school systems were forced to eliminate some counselor positions due to local financial problems. The extent of future growth in counselor employment will depend largely on the amount of funds which the Federal Government provides to the States for this purpose.

Earnings and Working Conditions

School counselors holding bachelor's degrees earned average annual salaries ranging from $7,900 to $11,400 during the 1971-72 school year, according to the National Education Association. For those having master's degrees, average yearly salaries were from $9,000 to $13,400. School counselors with doctorate's had an average maximum salary of almost $16,000 per year. School counselors generally earn more than teachers at the same school. (See statements on Kindergarten and Elementary School Teachers and Secondary School Teachers.)

In most school systems, counselors receive regular salary increments as they obtain additional education and expeience. Some counselors supplement their income by part-time consulting or other work with private or public counseling centers, government agencies, or private industry.

Sources of Additional Information

State Departments of Education can supply information on colleges and universities that offer training in guidance and counseling as well as on the State certification requirements.

Additional information on this field of work is available from:

American School Counselor Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

EMPLOYMENT COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Employment counselors (sometimes called vocational counselors) help jobseekers evaluate their abilities and interests so that they can choose, prepare for, and adjust to a satisfactory field of work. The extent of counseling services given by employment counselors varies, depending on the jobseeker and the type of agency. Jobseekers may include veterans, youth with little or no work experience, the handicapped, older workers, and individuals displaced by automation and industry shifts, or unhappy with their present occupational fields. Sometimes jobseekers are skilled in specific occupations and ready for immediate job placement, while those who have little education and lack marketable skills need intensive training to prepare them for jobs. In State employment services, the counselor is also concerned with helping those who are least employable, such as welfare recipients, prison releasees, and the educationally and culturally deprived.

Counselors interview jobseekers to learn employment-related facts about their interests, training, work experience, work attitudes, physical capacities, and personal traits. If necessary, they may get additional data by arranging for aptitude and achievement tests, and interest inventories, so that more objective help may be given. They may get additional information from sources such as former employers and schools.

When the jobseeker's background—his limitations and abilities—have been thoroughly reviewed, the employment counselor discusses occupational requirements and job opportunities in different

fields within the potential of the jobseeker. Then, the counselor and his client develop a vocational plan. This plan may specify a series of steps involving remedial education, job training, work experience, or other services needed to enhance the person's employability. Often, in developing this plan, the employment counselor works with a team of specialists.

In many cases, employment counselors refer jobseekers to other agencies for physical rehabilitation or psychological or other services before or during counseling. The counselor must be familiar with the available community services so that he can select those most likely to benefit a particular jobseeker.

Counselors may help jobseekers by suggesting employment sources and appropriate ways of applying for work. In many cases when further support and assistance are needed, counselors may contact employers to develop jobs for counseled applicants, although jobseekers usually are sent to placement interviewers after counseling. After job placement or entrance into training, counselors may follow up to determine if additional assistance is needed.

The expanding responsibility of public employment service counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. Also, it has led to group counseling and the stationing of counselors in neighborhood and community centers.

Places of Employment

In 1972, about 6,000 persons, half of them women, worked as employment counselors in State employment service offices, located in every large city and many smaller towns. In addition, about 2,500 employment counselors worked for various private or community agencies, primarily in the larger cities. Some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. Also, the Federal Government employed a limited number of employment counselors, chiefly in the Veterans Administration and in the Bureau of Indian Affairs. Some counselors teach in graduate training programs or conduct research.

Training, Other Qualifications, and Advancement

The national qualification standard for first level employment counselors in State employment service offices calls for 30 graduate semester hours of counseling courses beyond a bachelor's degree. However, 1 year of counseling-related experience may be substituted for 15 graduate semester hours.

All States require counselors in their public employment offices to meet State civil service or merit system requirements that include minimum educational and experience standards.

Applicants with advanced degrees and additional qualifying experience may enter at higher levels on the counselor career ladder. Many States also make provision for individuals with extensive experience in the Employment Service, whether or not they have college degrees, to enter the counselor career ladder and move upward by acquiring the prescribed university coursework and qualifying experience for each level.

Although minimum entrance requirements are not standardized among private and community agencies, most prefer, and some require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, counseling, guidance education, or public administration. Many private agencies prefer to have at least one staff member who has a doctorate in counseling psychology or a related field. For those lacking an advanced degree, employers usu-

ally emphasize experience in closely related work such as rehabilitation counseling, employment interviewing, school or college counseling, teaching, social work or psychology.

In each State, the public employment service offices provide some inservice training programs for their new counselors or trainees. In addition, both their new and experienced counselors are often given part-time training at colleges and universities during the regular academic year or at institutes or summer sessions. Private and community agencies also often provide inservice training opportunities.

College students who wish to become employment counselors should enroll especially in courses in psychology and basic sociology. At the graduate level, requirements for this field usually include courses in techniques of counseling, psychological principles and psychology of careers, assessment and appraisal, cultures and environment, and occupational information. Counselor education programs at the graduate level are available in about 370 colleges and universities, mainly in departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study.

Young people aspiring to be employment counselors should have a strong interest in helping others make vocational plans and carry them out. They should be able to work independently and keep detailed records.

Well-qualified counselors with experience may advance to supervisory or administrative positions in their own or other organizations. Some may become directors of agencies or of other counseling services, or area supervisors of guidance programs; some may become consultants; and others may become professors in the counseling field.

Employment Outlook

Employment counselors with master's degrees, and others with experience in related fields are expected to have favorable employment opportunities in both public and community employment agencies through the mid-1980's. Some of these openings will be due to deaths, retirements and transfers to other occupations.

Demand for employment counselors should increase as their role becomes more important in programs dealing with the training and retraining of unemployed workers, particularly those who are unskilled or whose jobs have been displaced by technology or industry shifts. Stimulating this demand is growing public recognition that more effort and services are needed if people with limited skills are to be able to find satisfactory jobs. Expansion of these programs and consequently the extent of growth in employment of counselors will depend in large part on the level of funding by the Federal Government, as well as on the distribution of revenue sharing monies allocated to these types of programs by the individual States.

Earnings and Working Conditions

Salaries of employment counselors in State employment services vary considerably by State. In 1972, minimum salaries ranged from about $6,900 to $13,000 a year with an average of $8,300. Maximum salaries ranged from $8,900 to $15,800 with an average of $10,700. More than one-half of the States listed maximum salaries of $10,000 or over. Trainees for counseling positions in some voluntary agencies in large cities were being hired at about $7,500 a year. Salaries of some employment counselors in private and community agencies were as high as $20,000, although the average was about $10,000 annually. In general, salaries of employment counselors are about one and one-half times as high as average earnings for nonsupervisory workers in private industry, except farming.

Most counselors work about 40 hours a week and have various benefits, including vacations, sick leave, pension plans, and insurance coverage. Counselors employed in community agencies may work overtime.

Sources of Additional Information

For general information on employment or vocational counseling, contact:

National Employment Counselors Association, 1607 New Hampshire Ave, NW., Washington, D.C. 20009.

National Vocational Guidance Association, Inc., 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

U.S. Department of Labor, Manpower Administration, USES, Division of Counseling and Testing, Washington, D.C. 20210.

The administrative office for each State's employment security agency, bureau, division, or commission can supply specific information about local job opportunities, salaries, and entrance requirements for positions in public employment service offices.

REHABILITATION COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Rehabilitation counselors help people with physical, mental, or social disabilities to adjust their vocational plans and personal lives. In

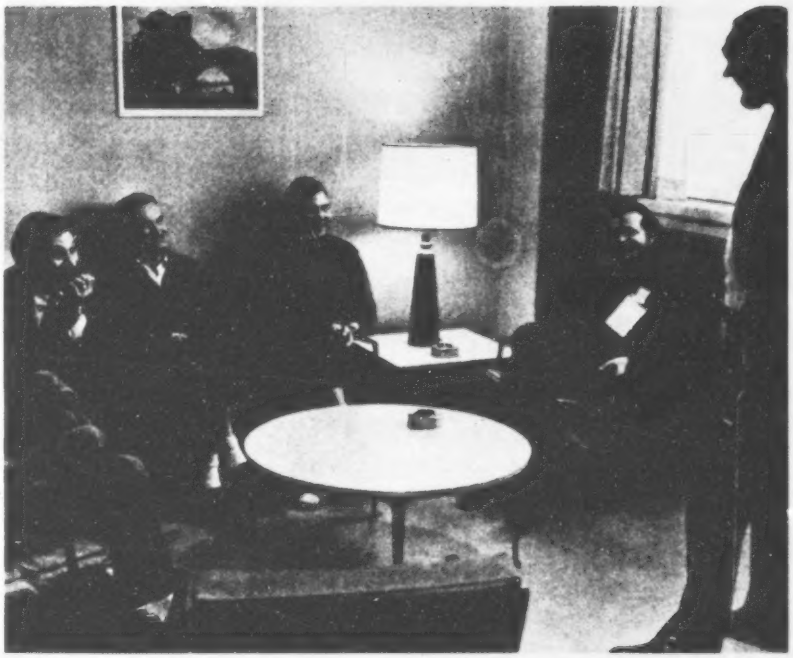
the initial contact with a client, the counselor learns about his interests and abilities, as well as his limitations. The counselor then uses this information, along with available medical and psychological data, to help the disabled person to evaluate himself—his physical and mental capacity and interests—in relation to suitable work.

Together, the counselor and client develop a plan of rehabilitation with the aid of other specialists responsible for the medical care and occupational training of the handicapped person. As the plan is put into effect, the counselor meets regularly with the disabled person to discuss his progress in the rehabilitation program and help resolve any problems that have been encountered. When the client is ready to begin work, the counselor helps him find a suitable job, and usually makes followup checks to insure that the placement has been successful.

Rehabilitation counselors must maintain close contact with the families of their handicapped clients, other professionals who work with handicapped people, agencies and civic groups, and private employers who hire the disabled. Counselors in this field often perform related activities, such as informing employers of the abilities of the handicapped and arranging for publicity of the rehabilitation program in the community.

An increasing number of counselors specialize in a particular area of rehabilitation; some may work almost exclusively with blind people, alcoholics or drug addicts, the mentally ill, or retarded persons. Others may work almost entirely with persons living in poverty areas.

The amount of time spent in counseling each client varies with the severity of the disabled person's problems as well as with the size of the counselor's caseload. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced counselors or those working with the severly disabled may work with relatively few cases at a time.



Rehabilitation counselor leads group counseling session with alcoholics.

Places of Employment

About 16,000 persons, one-third of them women, worked as rehabilitation counselors in 1972. About three-fourths worked in State and local rehabilitation agencies financed cooperatively with Federal and State funds. About 800 rehabilitation counselors and counseling psychologists worked for the Veterans Administration. Rehabilitation centers, sheltered workshops, hospitals, labor unions, insurance companies, special schools, and other public and private agencies with rehabilitation programs and job placement services for the disabled employ the rest.

Training, Other Qualifications, and Advancement

A bachelor's degree with courses in counseling, psychology, and related fields is the minimum educational requirement for rehabilitation counselors. However, employers are placing increasing emphasis on the master's degree in vocational counseling or rehabilitation counseling, or in related subjects such as psychology, education, and social work. Work experience in fields such as vocational counseling and placement, psychology, education, and social work is an asset for securing employment as a rehabilitation counselor. Most agencies have work-study programs whereby employed counselors can earn graduate degrees in the field.

Usually, 2 years of study are required for the master's degree in the fields preferred for rehabilitation counseling. In addition to a basic

foundation in psychology, courses generally included in master's degree programs are counseling theory and techniques, occupational and educational information, and community resources. Other requirements may include courses in placement and followup, tests and measurements, cultural and psychological effects of disability, and medical and legislative aspects of therapy and rehabilitation.

To earn the doctorate in rehabilitation counseling or in counseling psychology may require a total of 4 to 6 years of graduate study. Intensive training in psychology and other social sciences, as well as research methods is required.

Many States require that rehabilitation counselors be hired in accordance with State civil service and merit system rules. In most cases, these regulations require applicants to pass a competitive written test, sometimes supplemented by an individual interview and evaluation by a board of examiners.

Since rehabilitation counselors deal with the welfare of individuals who may otherwise be unemployed, the ability to accept responsibility is important. It also is essential that they be able to work independently and be able to motivate and guide the activity of others.

Counselors who have limited experience usually are assigned the less difficult cases. As they gain experience, their caseloads are increased and they are assigned clients with more complex rehabilitation problems. After obtaining considerable experience and more graduate education, rehabilitation counselors may be advanced to supervisory positions or top administrative jobs.

Employment Outlook

Employment opportunities for rehabilitation counselors are expected to be favorable through the mid-1980's. Persons who have graduate work in rehabilitation counseling or in related fields are expected to have the best employment prospects.

Contributing to the long run demand for rehabilitation counselors will be population growth with related increases in the number of people who need to be served. Stimulating this demand will be the extension of service to a greater number of the severely disabled, together with increased public awareness that the vocational rehabilitation approach helps the disabled to become self-supporting. The extent of growth in employment of counselors, however, will depend largely on levels of government funding for vocational rehabilitation. In addition to growth needs, many counselors will be required annually to replace those who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

Salaries of beginning rehabilitation counselors in State agencies averaged $8,700 a year in 1972. Experienced counselors earned average salaries of $11,500 a year; the range was $9,700 to $15,700 among the States.

The Veterans Administration paid counseling psychologists with a two-year master's degree and one year of subsequent experience—and those with a Ph.D.—starting salaries of $14,000 in early 1973. Those with a Ph.D. and a year of experience, and those with a 2-year master's degree and much experience, started at $16,700. Some rehabilitation counselors with a bachelor's degree were hired at starting salaries of $9,500 and $11,600. In general, salaries of employment counselors are above the average earnings for nonsupervisory workers in private industry, except farming.

Counselors may spend only part of their time in their offices counseling and performing necessary paperwork. The remainder of their time is spent in the field, working with prospective employers, training agencies, and the disabled person's family. The ability to drive a car often is necessary for field work.

Rehabilitation counselors generally work a 40-hour week or less, with some overtime work required, since, they often must attend community and civic meetings in the evenings. They usually are covered by sick and annual leave benefits, and pension and health plans.

Sources of Additional Information

For information about rehabilitation counseling as a career, contact:

American Psychological Association, Inc., 1200 17th St. NW., Washington, D.C. 20036.

American Rehabilitation Counseling Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

National Rehabilitation Counseling Association, 1522 K St. NW., Washington, D.C. 20005.

COLLEGE CAREER PLANNING AND PLACEMENT COUNSELORS

(D.O.T. 166.268)

Nature of the Work

Choosing a career and deciding whether or not to go to graduate school are among the difficult decisions faced by many college students. Career planning and placement counselors are employed by

colleges to offer encouragement and assist in these decisions.

Career planning and placement counselors, sometimes called college placement officers, provide a variety of services to college students and alumni. They assist students in making career selections by encouraging them to examine their interests, abilities, and goals, and then aiding them in exploring possible career alternatives and choosing an occupational area that is best suited to their individual needs. They advise students considering dropping out of the opportunities open to them. They also help students to get part-time and summer jobs.

Career planning and placement counselors arrange for job recruiters to visit the campus to discuss their firm's personnel needs and to interview applicants. They provide employers with information about students and help in appraising students' qualifications. They must keep abreast of information concerning job market developments in order to contact prospective employers, help students prepare for promising fields, and encourage the faculty and school administration to provide pertinent courses. Many counselors also assemble and maintain a library of career guidance information and recruitment literature.

College career planning and placement counselor discusses career alternatives with college student.

Placement counselors may specialize in areas such as law, education, or part-time and summer work. However, the extent of specialization usually depends upon the size and type of college as well as the size of the placement staff.

Places of Employment

Nearly all 4-year colleges and universities and many of the increasing number of junior colleges provide career planning and placement services to their students and alumni. Large colleges may employ several counselors working under a director of career planning and placement activities; in many institutions, however, a combination of placement functions is performed by one director and his clerical staff. In some colleges, especially the smaller ones, the functions of career counselors may be performed on a part-time basis by members of the faculty or administrative staff. Universities frequently have placement officers for each major branch or campus.

About 3,800 persons, one-third of them women, worked as career planning and placement counselors in 1972. Most of those in four-year schools were employed on a full-time basis. Of the 1,000 in junior colleges, about two-thirds worked part-time.

Training, Other Qualifications, and Advancement

Although no specific educational program exists to prepare persons for career planning and placement work, a bachelor's degree, preferably in a behavioral science such as psychology or sociology, is customary for entry into the field and a master's degree is increasingly being stressed.

In 1972, more than 100 colleges and universities offered graduate programs in college student personnel work. Graduate courses that are helpful for career planning and placement counseling include counseling theory and techniques, vocational testing, theory of group dynamics, and occupational research and employment trends.

Some people enter the career planning and placement field after gaining a broad background of experience in business, industry, government, or educational organizations. An internship in a career planning and placement office also is helpful.

College career planning and placement counselors must have an interest in people. They must be able to communicate with and gain the confidence of students, faculty, and employers in order to develop insight into the employment problems of both employers and students. People in this field should be energetic and able to work under pressure, since they must organize and administer a wide variety of activities.

Advancement for career planning and placement professionals usually is through promotion to an assistant or associate position, director of career planning and placement, director of student personnel services, or some other higher level administrative position. However, the extent of such opportunity usually depends upon the type of college or university and the size of the staff.

Employment Outlook

The overall employment outlook for well-qualified college career planning and placement counselors is expected to be favorable through the mid-1980's. College enrollments are expected to continue increasing through the early 1980's, a factor which is likely to contribute to a moderate growth of employment in

this field. Demand will be greatest in junior and community colleges, where enrollment increases are projected to be very rapid and where, in many cases, there are no career counseling and placement programs at present. Also contributing to the demand will be expected continued expansion in services to students from minority and low-income groups, who require special counseling in choosing careers, and assistance in finding part-time jobs to help pay for their education.

However, many institutions of higher education faced financial problems in 1972. If this situation persists into the mid-1970's, colleges and universities may be forced to limit expansion of counseling and placement services, resulting in competition for available positions in this field during this period.

Earnings and Working Conditions

The median salary of college career planning and placement counselors was more than $13,000 a year in 1972, according to a National Education Association survey of public and private colleges and universities. Median salaries in large public universities ranged from about $15,000 to $19,000; in small private colleges, from $7,000 to $10,000. In general, salaries of college career planning and placement counselors are about twice as high as average earnings for non-supervisory workers in private industry except farming.

Career planning and placement counselors frequently work more than a 40-hour week; irregular hours and overtime often are necessary, particularly during the "recruiting season." Most counselors are employed on a 12-month basis. They are paid for holidays and vacations and usually receive the same benefits as other professional personnel employed by colleges and universities.

Sources of Additional Information

A list of schools that offer courses in career counseling and placement and a booklet on the college student personnel professions, as well as other information on career counseling and placement, are available from:

The College Placement Council, Inc., P.O. Box 2263, Bethlehem, Pa. 18001.

CLERGYMEN

Deciding to become a clergyman involves considerations different from those involved in another career choice. When young persons choose to enter the ministry, priesthood, or rabbinate, they do so primarily because they posses a strong religious faith and a desire to help others.

Nevertheless, it is important for the young to know as much as possible about the profession and how to prepare for it, the kind of life it offers, and its needs for personnel.

The number of clergymen needed is related to the size and the geographic distribution of the Nation's population and its participation in organized religious groups. These factors affect the numbers of churches and synagogues established and of pulpits to be filled. In addition to the clergy who serve congregations, many others teach or act as administrators in seminaries and in other educational institutions; still others serve as chaplains in the Armed Forces, industry, correctional institutions, hospitals or on college campuses; or render service as missionaries, or in social welfare agencies.

A young person considering a career as a clergyman should seek the counsel of a religious leader of his faith to aid in evaluating his qualifications. The desire to serve the spiritual needs of others and a deep religious belief are the most important qualifications. To deal effectively with all types of people, clergymen need to be well-rounded both educationally and socially, and able to speak and write effectively. They should have emotional stability, as well as a sensitivity to other people's problems, and should also be able to motivate people. Some supervisory ability is important since they must direct the activities and business of church or synagogue. Clergymen should have initiative, self-discipline, and the ability to organize. They also should enjoy studying, because the ministry is an occupation that requires continuous learning. Clergymen are expected to be models of high moral and ethical standards for the whole community. Also, young persons considering this field should realize that the civic, social, and recreational activities of clergymen often are influenced and restricted by the customs and attitudes of the community.

To a large extent, the size and financial status of the congregation determines income. Usually, pay is highest in large cities or in prosperous suburban areas. Earnings usually rise with increased experience and responsibility.

Various additions to income have been traditional, as well. Most Protestant churches and a number of Jewish congregations provide housing. Roman Catholic priests ordinarily live in the parish rectory or in housing their religious order provides. Many clergymen receive transportation allowances or payment of other expenses. Gifts or fees for officiating at special ceremonies, such as weddings, may be an important source of additional income; however, clergymen frequently donate such earnings to charity. Some churches establish a uniform fee for special services which goes directly into the church treasury.

More detailed information on the clergy in the three largest faiths in the United States—Protestant, Roman Catholic, and Jewish—is given in the following statements, prepared in cooperation with leaders of these faiths. Information on the clergy in other faiths may be obtained directly from leaders of the respective groups.

PROTESTANT MINISTERS

(D.O.T. 120.108)

Protestant ministers lead their congregations in worship services and administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons, and give religious instructions to persons who are to become new members of the church. They also perform marriages; conduct funerals; counsel individuals who seek guidance; visit the sick, aged, and handicapped at home and in the hospital; comfort the bereaved; and serve church members in other helpful ways. Many Protestant ministers write articles for publication, give speeches, and engage in interfaith, community, civic, educational, and recreational activities sponsored by or related to the interests of the church. Some ministers teach in seminaries, colleges, and universities.

The services that ministers conduct differ among Protestant denominations and also among congregations within a denomination. In many denominations, ministers follow a traditional order of worship; in others they adapt the services to the needs of youth and other groups within the congregation. Most services include Bible reading, hymn singing, prayers, and a sermon. In some demoninations, Bible reading

by a member of the congregation and individual testimonials may constitute a large part of the service.

Ministers serving small congregations generally work on a personal basis with their parishioners. Those serving large congregations have greater administrative responsibilities, and spend considerable time working with committees, church officers, and staff, besides performing their other duties. They may have one or more associates or assistants who share specific aspects of the ministry, such as a Minister of Education who assists in educational programs for different age groups, or a Minister of Music.

Places of Employment

In 1972, about 325,000 ministers—about 5 percent of them women—served 72 million Protestants. In addition, thousands of ministers were in closely related occupations. Most ministers, however, serve individual congregations. The greatest number of clergymen are affiliated with the five largest groups of churches—Baptist, United Methodist, Lutheran, Presbyterian, and Episcopal.

All cities and most towns in the United States have at least one Protestant church with a full-time minister. Although the majority of ministers are located in urban areas, many live in less densely populated areas where they may serve two or more congregations.

Training and Qualifications

Educational requirements for entry into the Protestant ministry vary greatly. Some denominations have no formal educational requirements, and others ordain persons having varying amounts and types of training in Bible colleges, Bible institutes, or liberal arts colleges. A large number of denominations require a 3-year course of professional study in a theological school or seminary following college graduation. A degree of bachelor or master of divinity is awarded upon completion.

In 1972, there were 128 theological institutes accredited by the American Association of Theological schools. These institutions admit only students who have received a bachelor's degree or its equivalent from an accredited college.

Recommended pre-seminary courses include English, history, philosophy, the natural sciences, social sciences, the fine arts, music, religion, and foreign languages. However, the student considering theological study should contact, at the earliest possible date, the school or schools to which he intends to apply, in order to learn what will best prepare him for the program he expects to enter.

The standard curriculum recommended for accredited theological schools consists of courses in four major fields: Biblical, historical, theological, and practical. In recent years, greater emphasis has been placed on courses of a practical nature such as psychology, religious education, and administration. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer master of theology and doctor of theology degrees to students completing one year or more of additional study. Scholarships and loans are available for students of theological institutes.

In general, each large denomination has its own school or schools of theology that reflect its particular doctrine, interests, and needs; however, many of these schools are open to students from other denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering a wide range of theological points of view.

Persons who have denominational qualifications for the ministry usually are ordained following graduation from a seminary. In denominations that do not require seminary training, clergymen are ordained at various appointed times. Clergymen often begin their careers as pastors of small congregations or as assistant pastors in large churches.

Outlook

The shortage of Protestant ministers has abated significantly in recent years, with a marked reduction in demand for Protestant ministers who serve individual congregations. Causes have been the trend toward merger and unity among denominations, combined with the closing of smaller parishes, and the downturn in financial support. If this trend continues, new graduates of theological schools may face increasing competition in finding positions. The supply-demand situation will vary among denominations and depend, in part, on the length of the candi-

date's formal preparation. Most of the openings for clergymen that are expected through the mid-1980's will therefore result from the need to replace those in existing positions who retire, die, or leave the ministry.

Although fewer opportunities may arise for Protestant ministers to serve individual congregations, newly ordained ministers may find work in youth, family relations, and welfare organizations; religious education; on the campus; and as chaplains in the Armed Forces, hospitals, universities, and correctional institutions.

Sources of Additional Information

Persons who are interested in the Protestant ministry should seek the counsel of a minister or church guidance workers. Additional information on the ministry is available from many denominational offices. Each theological school can supply information on admission requirements.

RABBIS

(D.O.T. 120.108)

Nature of Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct daily services and deliver sermons at services on the Sabbath and on Jewish holidays. Rabbis customarily are available at all times to counsel members of their congregation, other followers of Judaism, and the community at large. Like other clergymen, rabbis conduct weddings and funeral services, visit the sick, help the poor, comfort the bereaved, supervise religious education programs, engage in interfaith activities, and involve themselves in community affairs.

Rabbis serving large congregations may spend considerable time in administrative duties, working with their staffs and committees. Large congregations frequently have an associate or assistant rabbi. Many assistant rabbis serve as Educational Directors.

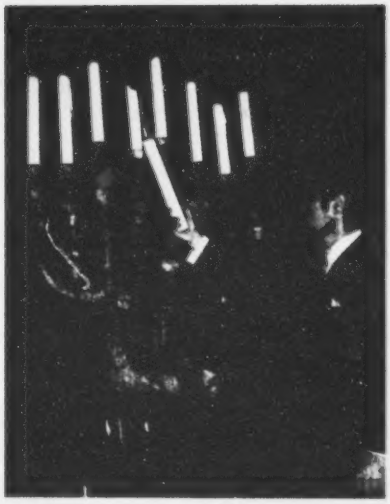
Rabbis serve either Orthodox, Conservative, or Reform congregations. Regardless of their particular point of view, all Hebrew congregations preserve the substance of Jewish religious worship. The congregations differ in the extent to which they follow the traditional form of worship—for example, in the wearing of head coverings, the use of Hebrew as the language of prayer, or the use of music or a choir. The format of the worship service and, therefore, the ritual that the rabbis use may vary even among congregations belonging to the same branch of Judaism.

Rabbis also may write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Places of Employment

More than 5,800 rabbis served nearly 5.9 million followers of the Jewish faith in this country in 1972. Most are Orthodox rabbis; the rest are about equally divided between Conservative and Reform congregations. The majority of rabbis are the spiritual leaders of individual congregations. The others are engaged in other activities mentioned in the introduction to this section, except for missionary work, which never has been a tradition of Judaism.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States that have large Jewish populations,



particularly New York, California, Pennsylvania, New Jersey, Illinois, Massachusetts, Florida, Maryland, and the Washington, D.C. metropolitan area.

Training, and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete the prescribed course of study. Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary is associated.

Nearly 30 seminaries train Orthodox rabbis in programs of varying lengths. Two of the larger seminaries require the completion of a 4-year college course for ordination. However, students who are not college graduates may spend a longer period at these seminaries and complete the requirements for the bachelor's degree while pursuing the rabbinic course. The other Orthodox seminaries do not require a college degree to qualify for ordination, although students who qualify usually have completed 4 years of college.

The Hebrew Union College—Jewish Institute of Religion is the official seminary that

trains rabbis for the Reform branch of Judaism. The Jewish Theological Seminary of America is the official seminary that trains rabbis for the Conservative branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as earlier preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Normally five years of study are required to complete the rabbinic course at the Reform seminary, including one year of preparatory study in Jerusalem. Exceptionally well-prepared students can shorten this 5-year period to a minimum of three years. A student having a strong background in Jewish studies can complete the course at the Conservative seminary in four years; for other enrollees, the course may take as long as six.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive knowledge of the Bible, Talmud, Rabbinic literature, Jewish history, theology, and courses in education, pastoral psychology, and public speaking. The Reform seminary places less emphasis on the study of Talmud and Rabbinic literature; it offers, instead, a broad course of study that includes subjects such as human relations and community organization.

Some seminaries grant advanced academic degrees in fields such as Biblical and Talmudic research. All Jewish theological seminaries make scholarships and loans available.

Newly ordained rabbis usually begin as leaders of small congregations, assistants to experienced rabbis, directors of Hillel Foundations, teachers in seminaries and other educational institutions, or chaplains in the Armed Forces. As a rule, the pulpits of large and well-established Jewish congregations are filled by experienced rabbis.

Outlook

In 1972, the number of rabbis in this country was inadequate to meet the expanding needs of Jewish congregations and other organizations desiring their services. This situation is likely to persist through the mid-1980's, despite an anticipated increase in the number of students graduating from the Jewish theological seminaries.

One cause underlying the demand for rabbis is a continued growth in Jewish religious affiliation in the number of synagogues and temples, particularly in the suburbs of cities having large Jewish communities. Another is the demand of large congregations for assistant rabbis. However, there is a trend toward merger of several congregations in some communities, and this could effect somewhat the need for rabbis. Demand for rabbis to work with social welfare and other organizations connected with the Jewish faith also is expected to increase. Immigration, once an important source of rabbis, is no longer significant. In fact, graduates of American seminaries now are in demand for Jewish congregations in other countries. Over 450 American rabbis now serve in other countries.

Sources of Additional Information

Young people who are interested in entering the rabbinate should seek the guidance of a rabbi. Information on the work of a rabbi and occupations allied to it is available also from many of the local Boards of Rabbis in large communities. Each Jewish theological seminary can supply information on its admission requirements.

ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

Nature of the Work

Roman Catholic priests attend to the spiritual, moral, and educational needs of the members of their church. Their duties include offering the Sacrifice of the Mass; offering religious enlightenment in the form of a sermon; hearing confessions; administering the Sacraments, (including the sacrament of marriage); and conducting funeral services. They also comfort the sick, console relatives and friends of the dead, counsel those in need of guidance, and assist the poor.

Priests spend long hours working for the church and the community. Their day usually begins with morning meditation and Mass, and may end with the hearing of confessions or an evening visit to a hospital or a home. Many priests direct and serve in church committees, and in civic and charitable organizations; they may assist in community projects, as well.

There are two main classifications of priests—diocesan (secular) and religious. Both types have the same powers acquired through ordination by a bishop. The differences lie in their way of life, the type of work to which they are assigned, and the church authority to whom they are immediately subject. Diocesan priests generally work on an individual basis in parishes, assigned to them by the bishop of their diocese. Religious priests generally work as part of a religious community comprised of members of the same religious order, such as the Jesuits, Dominicans, or Franciscans. They engage in specialized activities such as teaching or missionary work assigned to them by the superiors of their order.

Both religious and diocesan priests hold teaching and administrative posts in Catholic seminaries, colleges and universities, and high schools. Priests attached to religious orders staff a large proportion of the institutions of higher education and many high schools, whereas diocesan priests are concerned with the parochial schools attached to parish churches and with diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and abroad.

Places of Employment

More than 58,000 priests served nearly 49 million Catholics in the United States in 1972. There are priests in nearly every city and town and in many rural communities; however, the majority are in metropolitan areas, where most Catholics reside. Catholics are concentrated in the Northeast and the Great Lakes regions, with smaller concentrations in California, Texas, and Louisiana. A large number of priests are located in communities near Catholic educational and other institutions.

Training and Other Qualifications

Preparation for the priesthood requires 8 years more of study beyond high school. There are 450 seminaries offering such education. Study in preparation may begin in the first year of high school, at the college level, or in theological seminaries after college graduation.

High school seminaries provide a college preparatory program that emphasizes English grammar, speech, literature, and social studies. Two years of Latin are required and the study of modern language is encouraged. The seminary college offers a liberal arts program, stressing philosophy and religion; the study of man through the behavioral sciences and history; and the natural sciences and mathematics. In many college seminaries, a student may concentrate in any of these fields.

The remaining 4 years of preparation includes sacred scripture; apologetics (the branch of theology concerning the defense and proofs of Christianity); dogmatic, moral, and pastoral theology; homiletics (art of preaching); church history; liturgy (Mass); and canon law. Diocesan and religious priests attend different major seminaries, where slight variations in the training reflect the differences in the type of work expected of them as priests. During the later years of their seminary courses, candidates receive from their bishop a succession of orders (positions) culminating in their ordination to the priesthood. Priests are not permitted to both marry and remain priests.

Most postgraduate work in theology is given either at Catholic University of America, Washington, D.C., or at the ecclesiastical universities in Rome. Also, many priests do graduate work at other universities in fields unrelated to theology. Priests are commanded by the law of the Catholic Church to continue their studies, at least informally, after ordination.

Young men are never denied entry into seminaries because of lack of funds. In seminaries for secular priests, the bishop may make arrangements for student loans. Those in religious seminaries often are financed by contributions of benefactors.

The first assignment of a newly ordained secular priest is usually that of assistant pastor or curate. Newly ordained priests of religious orders are assigned to the specialized duties for which they are trained. Many opportunities for greater responsibility exist within the hierarchy of the church. Diocesan priests, for example, may rise to positions such as monsignor or bishop. Much of their time at this level is given to administrative duties. In the religious orders that specialize in teaching, priests may become heads of departments or assume other positions that include administrative duties.

Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the growing number of Catholics in the Nation. The number of ordained priests has been insufficient to fill the needs of newly established parishes and other Catholic institutions, and to replace priests who retire or die. This situation is likely to persist. However, many of the minor duties of priests are being assigned to lay deacons (nonordained professionals). Although priests usually continue to work longer than persons in other

professions, the varied demands and long hours create a need for young priests to assist the older ones. Also, an increasing number of priests have been acting in many diverse areas of service—in social work; religious radio, newspaper, and television work; labor-management mediation. They have also been serving in foreign posts, as missionaries, particularly in countries that have a shortage of priests.

Sources of Additional Information

Young men interested in entering the priesthood should seek the guidance and counsel of their parish priest. For information regarding the different religious orders and the secular priesthood, as well as a list of the seminaries which prepare students for the priesthood, contact the Diocesan Directors of Vocations of the dioscesan chancery office.

OTHER SOCIAL SERVICE OCCUPATIONS

COOPERATIVE EXTENSION SERVICE WORKERS

(D.O.T. 096.128)

Nature of the Work

Extension service workers are engaged with the farm area population in educational work in topics like agriculture, home economics, youth activities, and community resource development. They are employed jointly by State land grant universities and the U.S. Department of Agriculture. Extension workers must be proficient in both subject matter and teaching methods.

Extension workers help farm families analyze and solve their farm and home problems and aid in community improvement. Much of this educational work is carried on in groups, through meetings, tours, demonstrations, and use of local volunteer leaders. On problems that cannot be solved satisfactorily by such group methods, individual assistance is given. Extension workers rely heavily on use of mass communication media such as newspaper, radio, and television.

County extension workers help farmers produce, more efficiently, higher quality crops and livestock. They also help them develop new market outlets and plan production to meet market demands, including those for quality standards and varieties. They also help community leaders to improve the community, and to plan and provide for economic development, recreation, and more adequate public facilities such as schools, water supply and sewer systems, and libraries. They help homemakers to provide more family enjoyment from existing resources, a higher level of nutrition, and a more pleasant home environment. Some extension workers help youths to become more useful citizens and to gain more personal satisfaction through programs in career selection, recreation, health, and leadership. The essence of extension work is to help people help themselves to achieve the goals they think are important.

Cooperative extension workers advise farmers about crop yields.

County extension workers are supported by State Extension Specialists. The latter's job is to keep abreast of the latest research in their particular fields of interest, interpret this for use in extension programs, and help county extension workers develop educational programs, activities, and events to demonstrate use of this new knowledge.

Cooperative Extension Services employ persons with a wide range of skills. Staffs include workers skilled in all phases of crop and livestock production, conservation, environmental improvement, farm management and marketing, family living, human development, nutrition, home management, child development, sociology, psychology, veterinary medicine, engineering, textiles and clothing, resource economics, and business and public administration.

Places of Employment

Extension workers are located in county offices, area offices serving multi-county units, and State offices, the latter usually on the cam-

pus of the land-grant college or university.

Agents are located in nearly every county in the 50 States, Puerto Rico, and the District of Columbia. The county staffs range in size from one agent (serving a wide variety of clientele interests) to staffs of a dozen or more specialized agents in counties with high-density population and great diversity of interests. Staffs are located in counties ranging from the most rural to the most urban.

Training and Other Qualifications

Cooperative Extension agents assigned to counties are required to be proficient in disciplines related to the needs and programs of the clientele with whom they work. Each must have a B.S. degree in his subject-matter field; and some training in educational techniques is desirable, as well.

Often, they receive training in extension techniques in a pre-induction training program, and are upgraded through regular in-service training programs in both educational techniques and the subject-matter for which they are responsible. In addition to subject-matter proficiency and extension techniques, successful extension workers must like to work with people and to help them.

In most States, specialists and agents assigned to multicounty and State staff jobs are required to have at least one advanced degree and many must have the Ph.D.

Employment Outlook

Extension services employ more than 15,600 professional people. The demand for additional workers is expected to continue, especially in depressed rural areas. As agricultural technology becomes more complicated, and as farm people become more aware of the need for organized activity, more help will be sought from trained Extension Service personnel. The Extension Service also is being extended to new segments of the population, as residents recognize the value of their assistance, particularly in helping the disadvantaged.

Counterparts of the Cooperative Extension Service are being established in many countries, and Extension Service personnel often are recruited to help initiate and organize these programs.

Earnings and Working Conditions

The salaries of extension workers vary from State to State and county to county. In the main, however, they are fully competitive with similar jobs in industry and government. Generally speaking, the career ladder for extension workers proceeds from assistant county agent to more responsible jobs within that county, or in another county in the State, to assignments on the State extension staff.

Sources of Additional Information

Additional information may be obtained from county extension offices, the State Director of the Cooperative Extension Service located at each land-grant university; or the Extension Service, U.S. Department of Agriculture, Washington, D.C. 20250.

HOME ECONOMISTS

(D.O.T. 096.128)

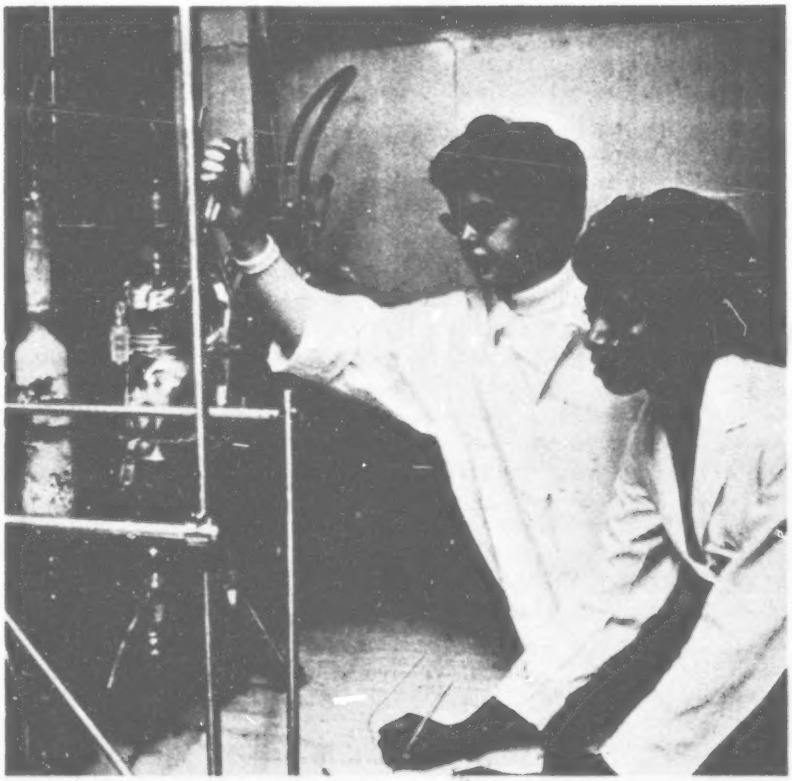
Nature of the Work

Home economists work to improve products, services, and practices that affect the comfort and well-being of the family. They may specialize in food and nutrition, clothing and textiles, child development and family relations, housing, home furnishings and equipment, home management, or consumer economics, or they may have a broad knowledge of the whole professional field.

Most home economists work as teachers. They teach high school students about foods and nutrition; clothing, selection, construction and care; child development; consumer education; housing and home furnishings; and family relations, and other subjects related to family living and homemaking. They also perform the regular duties of other high school teachers that are described in the statement on secondary school teachers elsewhere in the Handbook.

Teachers in adult education programs help men and women to increase their understanding of family relations and to improve their homemaking skills. They also conduct training programs on secondary, post secondary, and adult levels for jobs related to home economics. Special emphasis is given to teaching those who are disadvantaged and handicapped. College teachers may combine teaching and research, and often specialize in a particular area of home economics.

Home economists employed by private business firms and trade associations promote the development, use, and care of specific home products. They may do research, test products, and prepare advertisements and instructional materials.



Home economists do research on metabolism.

Other duties may include preparing and presenting programs for radio and television, serving as consultants; giving lectures and demonstrations before the public, and conducting classes for salesmen and appliance servicemen. Some home economists study consumer needs and help manufacturers translate these needs into useful products.

Food manufacturers employ home economists to work in test kitchens or laboratories to improve products and help create new ones. They also may publicize the nutritional values of their company's foods. Utility companies hire home economists to demonstrate appliances and services and to give advice on household problems. Home economists employed by kitchen and laundry equipment manufacturers may assist engineers on product development.

Home economists in the field of communications work for magazines, newspapers, radio and television stations, advertising and public relations agencies, and trade associations. They prepare articles, advertisements, and speeches about home economics products and services. They may also test and analyze products and study consumer buying habits.

Home economists are employed by dress-pattern companies, department stores, interior design studios, and other business firms to help design, manufacture, and sell products for the home. Financial institutions sometimes employ home economists to give customers advice on spending, saving, and budgeting.

Some home economists conduct research for the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The U.S. Department of Agriculture employs the largest group of researchers to do work such as study the buying and spending habits of families in all socio-economic groups and develop budget guides.

Home economists who work for the Cooperative Extension Service conduct adult education programs for men and women, and 4-H Club and other youth programs for girls and boys, in areas such as home management, consumer education, family relations and nutrition. Extension home economists also train and supervise volunteer leaders and paid aides who teach adults and youth. (See statement on Cooperative Extension Service Workers elsewhere in the *Handbook*.)

Federal, state, and local governments and private agencies employ home economists in social welfare programs to advise and counsel clients on the practical knowledge and skills needed for effective everyday family living. They may also help handicapped homemakers and their families adjust to the physical as well as social and emotional limitations by changing the arrangements in the home; finding efficient ways to manage household chores; aiding in the design, selection and arrangement of equipment; and creating other methods and devices to enable disabled people to function at their highest possible level. Other home economists in welfare agencies supervise or train workers who provide temporary or part-time help to households disrupted by illness.

Home economists in health services provide special help and guidance in home management, consumer education and family economics as it relates to family health and well-being. Activities of home

economists working in health programs are home visits, conducting clinic demonstrations and classes in homemaking skills, financial counseling, assisting the mentally retarded mother, working with agencies and community resources, and supervising nutrition and home management aides.

Places of Employment

About 120,000 people worked in home economics professions in 1972. This figure includes 33,000 dietitians and 5,300 Cooperative Extension workers who are discussed in separate statements elsewhere in the *Handbook*. About 70,000 home economists are teachers, of whom about 50,000 teach in secondary schools. More than 15,000 are adult education instructors, some of whom teach part-time in secondary schools; about 5,000 home economists teach in colleges and universities. Others teach in community colleges, elementary schools, kindergartens, nursery schools and recreation centers.

More than 5,000 home economists work in private business firms and associations. Several thousand are in research and social welfare programs. A few are self-employed.

Although home economics generally has been considered a women's field, a growing number of men are employed in home economics positions. Most men specialize in foods and institutional management, although some are in the family relations and child development field, applied arts, consumer education, and other areas.

Training, Other Qualifications, and Advancement

About 370 colleges and universities offer a bachelor's degree in home economics, which qualifies graduates for most entry positions in the field. A master's or doctor's degree is required for college teaching, for certain research and supervisory positions, for work as an extension specialist, for some supervisory jobs, and for some jobs in the nutrition field.

Home economics majors study sciences and liberal arts—particularly social sciences—as well as specialized home economics courses. They may concentrate in a particular area of home economics or in what is called general home economics. Advanced courses in chemistry and nutrition are important for work in foods and nutrition; science and statistics for research work; and journalism for advertising, public relations work, and all other work in the communications field. To teach home economics in high school, students must complete the courses required for a teacher's certificate.

Scholarships, fellowships, and assistantships are available for undergraduate and graduate study. Although colleges and universities offer most of these financial grants, government agencies, research foundations, businesses, and the American Home Economics Association Foundation provide additional funds.

Home economists must be able to work with people of various incomes and cultural backgrounds and should have a capacity for leadership. Good grooming, poise, and an interest in people also are essential for those who deal with the public. The ability to write and speak well is important.

Home economists frequently gain experience as teachers and advance to responsible positions in business, extension service work, supervision, and teacher education. Those who leave the profession, but later wish to return, may find jobs as part-time or full-time adult education teachers in programs such as the Cooperative Extension Service.

Employment Outlook

Home economists, especially those wishing to teach in high schools, may face some competition for jobs through the mid-1980's. Other areas of home economics also may experience competitive job market conditions as those unable to find teaching jobs look for other home economists positions. However, for those willing to continue their education toward an advanced degree, employment prospects in college and university teaching are expected to be good.

Although employment of home economists is expected to grow slowly, many jobs will become available each year to replace those who die, retire, or leave the field for other reasons. Growth will result from increasing awareness of the contributions that can be made by professionally trained home economists in quality child care, nutrition, housing and furnishings design, consumer education information, and man-environment relations. They also will be needed to promote home products, to act as consultants to consumers and to do research for improvement of home products and services. The Vocational Education Amendments of 1968, which provide funds for consumer and homemaking education at the secondary, post-secondary, and adult levels, and focus on the needs of low income families, should further stimulate the need for home economists.

Earnings and Working Conditions

Home economics teachers in public schools generally receive the same salaries as other teachers. In 1972, the average starting salary of

public school teachers with a bachelor's degree was $7,400, according to a National Education Association survey. Experienced teachers averaged $10,500. Median salaries of women teaching in colleges and universities in 1972 ranged from $8,900 for instructors to $16,400 for professors.

The Federal Government paid home economists with bachelor's degrees starting salaries of $7,700 and $9,500 in early 1973, depending on their scholastic record. Those with additional education and experience generally earned from $11,600 to $19,700 or more, depending on the type of position and level of responsibility.

Cooperative extension workers on the county level averaged $10,300 while those on the State level averaged $14,200 in 1972. In general, home economists earn about one and one-half times as much as non-supervisory workers in private industry, except farming.

Home economists usually work a 40-hour week. Those in teaching and extension positions, however, frequently work longer hours because they are expected to be available for evening lectures, demonstrations, and other work. Most home economists receive fringe benefits, such as paid vacation, sick leave, retirement pay, and insurance benefits.

Sources of Additional Information

A list of schools granting degrees in home economics and additional information about home economics careers, the types of home economics majors offered in each school granting degrees in home economics, and graduate scholarships are available from:

American Home Economics Association, 2010 Massachusetts Ave. NW., Washington, D.C. 20036

PSYCHOLOGISTS

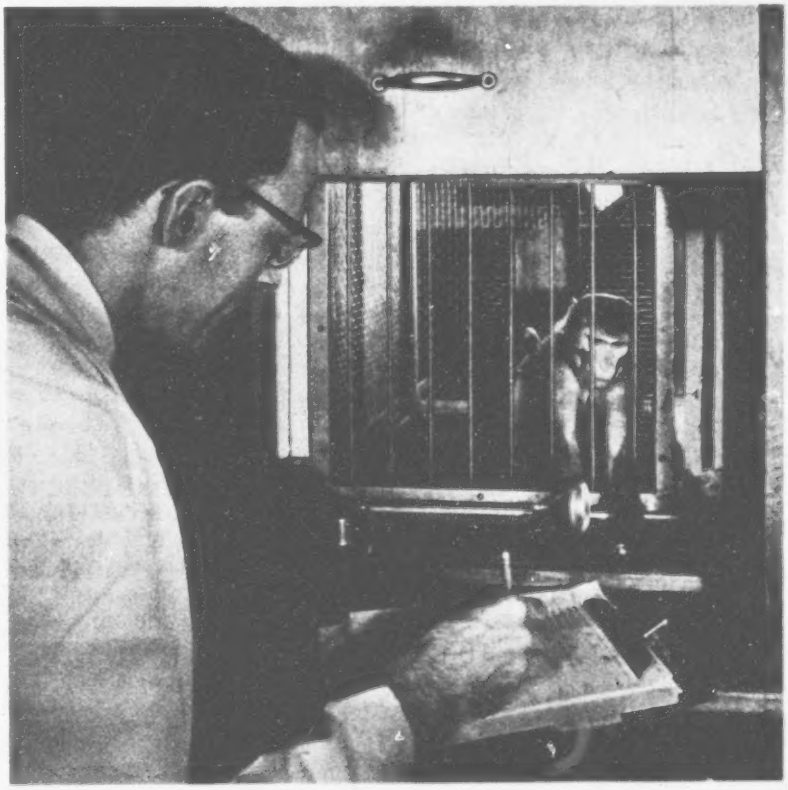
(D.O.T. 045.088 and .108)

Nature of the Work

Psychologists study the normal and abnormal behavior of individuals and groups in order to understand and explain their actions. In the course of their work, they may be concerned with the problems of emotional stress and abnormal behavior, the causes of low morale, or the effective performance of an astronaut. Some teach in colleges and universities; others provide counseling services, plan and conduct training programs for workers, conduct research, advise on psychological methods and theories, or administer psychology programs in hospitals, clinics, or research laboratories. Many psychologists combine several of these activities.

Psychologists gather information about the capacities, interests, and behavior of people in various ways. They interview individuals, develop and administer tests and rating scales, study personal histories and conduct controlled experiments. Psychologists also often design and conduct surveys.

Areas of specialization in psychology include *experimental psychology*—in which behavior processes are studied in the laboratory; *developmental psychology*—the study of the causes of behavioral changes as people progress through



Psychologist experiments with monkey for insight into human behavior.

life; *personality*—the study of the processes by which a person becomes a unique individual; *social psychology*—in which people's interactions with others and with the social environment are examined; *educational and school psychology*—which are concerned with the psychological factors in the process of education; *comparative psychology*—in which the behavior of different animals, including man, is compared; *physiological psychology*—the study of the relationship of behavior to the biological functions of the body; and *psychometrics*—the development and application of procedures for measuring psychological variables.

Psychologists often combine several areas of psychology in their specialty. *Clinical psychologists* are the largest group of specialists. They generally work in mental hospitals or clinics, and are involved mainly with problems of mentally or emotionally disturbed people. They interview patients, give diagnostic tests, and provide individual, family, and group psychotherapy, and design and carry through behavior modification programs. *Counseling psychologists* help people with important problems of everyday living. In their work, they may use developmental psychology, psychopathology, personality, educational psychology, and psychometrics. Other combination fields are *industrial and organizational psychology* where problems of motivation and morale in work situations are studied; *engineering psychology*, the development and improvement of man-machine systems; *consumer psychology*, the study of the psychological factors that determine an individual's behavior as a consumer of goods and services; and *environmental psychology*, the relationships between individual qualities and the environment.

Places of Employment

About 57,000 people, one-fourth of them women, worked as psychologists in 1972. More than 40 percent of the total worked in colleges and universities, either as teachers, researchers, or counselors. The second largest number of psychologists work for Federal, State, and local government agencies. Federal agencies that employ the most psychologists are the Veterans Administration, the Department of Defense, and the Public Health Service.

Many psychologists work in public schools, clinics, hospitals, medical schools, and for business or industry. Some are in independent practice, and others serve as commissioned officers in the Armed Forces and the Public Health Service.

Training, Other Qualifications, and Advancement

Generally, a master's degree in psychology is the minimum educational requirement for professional employment in the field. People who have this degree can qualify for positions where they administer and interpret psychological tests, collect and analyze statistical data, conduct research experiments, and perform administrative duties. They also may teach in colleges, counsel students or handicapped persons, or—if they have had previous teaching experience—work as school psychologists or counselors. (See statements on School Counselors and Rehabilitation Counselors.)

A Ph.D. degree—the mark of the full professional—is needed for many entrance positions and is becoming increasingly important for advancement. People who have doctorates in psychology qualify for the more responsible research, clinical, and counseling positions, as well as for the higher level positions in colleges and universities and in Federal and State programs.

At least 1 year of full-time graduate study is needed to earn a master's degree in psychology. An additional 3 to 5 years of graduate work usually are required in order to get a Ph.D. In clinical or counseling psychology, the requirements for the Ph.D. degree generally include an additional year of internship or supervised experience.

Some universities require applicants for graduate work in psychology to have had an undergraduate major in that field. Others prefer broader educational backgrounds that include not only some basic psychology but also courses in the biological, physical, and social sciences, statistics, and mathematics.

Many graduate students receive financial help in the form of fellowships, scholarships, or part-time employment from universities and other sources. Several Federal agencies provide funds to graduate students, generally through the college or university that provides the training. The Veterans Administration offers a number of pre-doctoral traineeships, during which time the students receive payments and gain supervised experience in VA hospitals and clinics. The National Science Foundation, the U.S. Office of Education, the Public Health Service, the Rehabilitation Services Administration, and the National Institute of Mental Health also provide fellowships, grants, and loans for advanced training in psychology. However at present the trend at the federal level is toward low-interest loans and away from fellowships and grants.

The American Board of Professional Psychology awards diplomas in clinical, counseling, industrial, and school psychology to those who have outstanding educational records and

experience and who pass the required examinations.

Psychologists who want to enter independent practice must meet certification or licensing requirements in an increasing number of States. In 1972, 46 States had these requirements.

People pursuing a career in psychology must be emotionally stable, mature, and able to deal effectively with people. Sensitivity, patience, and a genuine interest in others are particularly important for work in clinical and counseling psychology. Research psychologists should be able to do detailed and independent work; verbal and writing skills are necessary to communicate research findings.

Employment Outlook

Employment opportunities for psychologists are expected to be good through the mid-1980's. Opportunities should be very good for Ph.D.'s and for some master's degree holders specializing in clinical or counseling psychology.

Employment of clinical, counseling, and social psychologists in mental hospitals, correctional institutions, mental hygiene clinics, and community health centers is expected to expand rapidly. Many openings for psychologists also are anticipated in the Federal Government, primarily in the Veterans Administration and the Department of Defense.

Psychologists may find some competition for job openings in large colleges and universities which are preferred locations for many specialties in psychology. However, those wishing to work in the relatively smaller and newer publicly-supported institutions should have good employment prospects. The rapid growth of two-year colleges also will create many openings for psychologists.

Other openings will exist for clinical, educational, and industrial psychologists. Growing awareness of the need for testing and counseling children is expected to increase the need for psychologists in schools. Increased public concern for the development of human resources as evidenced by Medicare and Medicaid will further increase the demand for psychologists. Other openings may occur as psychologists move into new employment fields where their services are beginning to be recognized as useful. Government agencies are finding that psychologists can conduct surveys and offer services, such as recommending methods for improving public opinion and anticipating reactions to government programs.

Many vacancies also will occur each year as a result of retirements and deaths. The transfer of psychologists to purely administrative work also will create some job vacancies.

Earnings and Working Conditions

In 1972, starting salaries for psychologists holding a master's degree averaged about $11,000 a year, according to the American Psychological Association. Beginning salaries for those holding a doctorate averaged $13,000.

Median salaries of psychologists teaching in graduate departments ranged from $12,800 for assistant professors to $20,900 for full professors during the academic year 1972-73 (9-10 months), according to a survey conducted for the Conference of Chairmen of Graduate Departments of Psychology.

In the Federal Government, psychologists having a Ph.D. degree and 1 year of internship started at $14,000 a year in early 1973. With 1 year of experience, Ph.D.'s earned about $16,700. The average salary for Ph.D. psychologists in the Veterans Administration was about $21,500 a year. In general, psychologists earn over twice as much as the average nonsupervisory worker in private industry, except farming.

Working conditions for psychologists who teach in colleges and universities are the same as for other faculty members. Most colleges provide for sabbatical leaves of absence, life and health insurance, and retirement plans. Working hours are generally flexible, but often entail some evening work with individual students or organized groups. Clinical and counseling psychologists often work in the evenings since their patients sometimes are unable to leave their jobs or school during the day.

Sources of Additional Information

For general information on career opportunities, certification or licensure requirements, and educational facilities and financial assistance for graduate students in psychology, contact:

American Psychological Association, 1200 17th Street, NW., Washington, D.C. 20036.

Information on traineeships and fellowships is available from colleges and universities that have graduate psychology departments.

RECREATION WORKERS

(D.O.T. 079.128, 159.228, 187.118, 195.168, 195.228)

Nature of the Work

Participation in sports, hobbies, and other recreation activities has become an integral part of the increasing leisure time enjoyed by many Americans. Recreation workers direct individual and group recreation activities to help people better enjoy nonworking hours and to promote physical fitness, fair play, and good sportsmanship.

Recreation workers organize and lead social, cultural, and physical education programs at camps, community centers, hospitals, work places, and playgrounds for people of various ages and interests. They also manage recreation facilities and study the recreation needs of groups and communities. There are three basic types of recreation workers: recreation leaders and camp counselors, activity specialists, and recreation directors.

Recreation leaders and camp counselors lead indoor and outdoor recreation activities. They instruct people in the proper use of facilities and the correct rules and techniques used in sports, games, and other activities.

Activity specialists lead and instruct people in specific activities such as archery, swimming, or tennis. They often conduct classes and coach teams in the activity in which they specialize.

Recreation supervisors or directors administer recreation programs, departments, and camps. They manage facilities and supervise recreation workers, maintenance personnel, and attendants. They develop new programs and organize sports leagues and teams, tournaments, and contests that bring people with similar interests together. Directors of city recreation departments, camps, or private nonprofit organizations coordinate and evaluate the many types of recreation programs and often prepare program budgets.

Recreation workers employed by local government and voluntary agencies direct activities at neighborhood playgrounds and indoor recreation centers. They provide instruction in the arts and crafts and in sports. They may supervise recreational activities at correctional institutions and work closely with social workers to organize programs for the young and the aged. School recreation workers organize the leisure-time activities of school-age children during schooldays, weekends, and vacations.

Recreation workers in industry and in the Armed Forces direct bowling leagues, softball teams, and similar activities for servicemen and company employees. They also often plan social functions and fund drives.

Under the supervision of a camp director, recreation workers in camps lead and instruct campers in nature-oriented forms of recreation such as swimming, hiking, and horseback riding. In resident camps, recreation workers must also safeguard the health and well-being of campers.

Therapeutic recreation workers plan recreation programs for the ill and the handicapped in hospitals, convalescent homes, and other institutions. Working under medical direction, they organize and direct sports, dramatics, arts, and crafts for persons suffering from mental problems and physical disabilities.

Places of Employment

More than 55,000 recreation workers were employed year-round in 1972; nearly one-half of them were women. Government recreation departments employed about one-half, primarily in local recreation departments. Many others worked for schools, commercial recreation establishments like camps or resort hotels, and nonprofit voluntary organizations such as athletic or scouting organizations, churches, and community organizations.

Although part-time recreation workers and volunteers assist full-time workers throughout the year, an additional 120,000 recreation workers were employed for the summer months only, during 1972. Seasonal workers are mostly college students and teachers who work primarily as recreation leaders and camp counselors.

Recreation workers are employed mostly in urban areas where many people must use the same playgrounds and recreation centers. Camp recreation workers, however, work generally in rural, less populated areas of the country. Camp recreation workers are employed at resident, day, family, and travel camps. Except for the director of very large camps and workers at the few camps which remain open year-round, all camp recreation workers are employed for two or three months only during the summer.

Training, Other Qualifications, and Advancement

A high school education is generally the minimum requirement for recreation leader and camp counselor jobs. However, an associate degree in recreation or a related subject, from a community or junior college usually is preferred for year-round employment.

Activity specialists should have an associate or bachelor's degree in recreation or in one of the arts, to hold year-round jobs. Part-time or seasonal work experience as a recreation leader or camp counselor

Recreation worker teaches camping skills.

often is required. Many activity specialists who concentrate in subjects such as drama, art, or dance have graduate degrees.

Generally recreation directors must have a bachelor's degree with a major in recreation, social science, or physical education as well as part-time or seasonal experience. Advanced courses in recreation or public administration leading to a master's degree are desirable for persons interested in higher level administrative positions.

The typical program of recreation study includes courses in communications, natural sciences, the humanities, philosophy, sociology, drama, and music. Specific courses in recreation include group leadership, program planning and organization, health and safety procedures, outdoor and indoor sports, dance, arts and crafts, and field work in which the student obtains actual recreation leadership experience. Students interested in industrial recreation may find it desirable to take courses in business administration; those interested in therapeutic recreation should take courses in psychology, health education, and sociology.

Young people planning careers as recreation workers must have the ability to motivate people and be sensitive to their needs. Good health and physical stamina are required to participate in sports. Activity planning often calls for creativeness and resourcefulness. Recreation workers should be able to accept responsibility and exercise judgment since they usually work alone. To increase their leadership skills and understanding of people, students should obtain related work experience in high school and college. They may do volunteer, part-time, or summer work in recreation departments, camps, youth-serving organizations, institutions and community centers.

Most college graduates then enter the recreation field as activity specialists or recreation directors. Beginning recreation director jobs include recreation facility director, community center director, and supervisor of recreation leaders and attendants. A small number of college graduates begin in jobs that lead directly to administrative recreation positions. A few large cities and organizations offer recreation director trainee programs that generally last 1 year.

After a few years' experience, activity specialists, and often recreation leaders, may become recreation directors. Opportunities for advancement to administrative positions often are limited for persons without graduate training. However, advancement is sometimes possible through a combination of education and experience.

Employment Outlook

Employment opportunities for persons having a bachelor's degree in recreation are expected to be excellent. As the number of college graduates with a major in recreation falls short of the demand, employment opportunities in this field will continue to be favorable for persons that have college training in social science, physical education, and health education. Opportunities for part-time and volunteer work should be plentiful, particularly in local government recreation departments.

Employment of recreation workers is expected to increase very rapidly through the mid-1980's. Population growth, increased leisure time and rising incomes underlie the expected growth in employment of recreation workers. As incomes rise, more people will participate in a variety of organized competitive and noncompetitive sports and larger numbers will travel to parks, camps, and resorts for camping, hiking, fish-

ing, and other recreation pursuits.

Public pressure for recreation areas may result in the creation of many new parks, playgrounds, and national forests, and increased attention to physical fitness by government, educators, and others may produce a rise in public and industrial recreation programs. Longer life and earlier retirements also will increase the demand for recreation programs for retired persons. All of these factors will increase the need for recreation workers.

Earnings and Working Conditions

Annual salaries for recreation leaders in State and local governments ranged between $7,000 and $9,000 in 1972, according to a survey by the Public Personnel Association. In general, earnings are higher than the average for nonsupervisory workers in private industry, except in farming.

Persons with bachelor's degrees in recreation generally received starting salaries ranging between $7,200 and $9,000, according to the National Recreation and Park Association. Recreation directors' salaries ranged from $11,000 to more than $20,000 depending on their responsibilities.

In early 1973, starting salaries for recreation workers in the Federal Government were $7,694 for applicants having a bachelor's degree or 3 years of recreation work experience. Persons with a good academic record, specialized training, or 4 years of experience could qualify for a starting salary of $9,520; those with a master's degree or an additional year of experience, $11,614.

Recreation worker salaries tend to be higher in the West than in other areas of the country.

The average workweek for recreation workers is 40 hours, although some work more than 50 hours. Many camp recreation workers live at the camps where they work, and their room and board is included in their salaries. Most public and private recreation agencies provide from 2 to 4 weeks vacation and other fringe benefits such as sick leave and hospital insurance.

A person entering the recreation field should expect some night work and irregular hours since they often work while others are enjoying leisure time. Recreation workers usually spend most of their time outdoors when the weather permits.

Sources of Additional Information

Information about recreation as a career, employment opportunities in the field, and colleges and universities offering recreation curriculums is available from:

National Industrial Recreation Association, 20 North Wacker Dr., Chicago, Ill. 60606.

National Recreation and Parks Association, 1601 North Kent St., Arlington, Va. 22209.

For information on careers in camping and job referrals, contact:

American Camping Association, Bradford Woods, Martinsville, Indiana 46151.

SOCIAL SERVICE AIDES

Nature of the Work

Social service or social welfare aides enable social service agencies to help greater numbers of people by freeing professional social workers and rehabilitation counselors from many routine duties. Most social service aides work under the close guidance and supervision of social workers or counselors.

Social service aides serve as a link between professional social workers or rehabilitation counselors and people who seek help from social agencies by welcoming visitors and learning the nature of their problems. Aides explain the services and facilities of the agency and help new applicants fill out eligibility forms. In some welfare agencies, aides visit the applicant's home, interview friends and relatives, and check documents such as marriage licenses or birth certificates to determine an individual's or family's eligibility for public assistance.

Much of the routine paperwork required in welfare programs is done by social service aides. They may keep fact sheets on clients up to date, maintain a filing system of reports or a control system for periodic case reviews, and fill out school enrollment, employment, medical, and compensation forms.

Aides usually referred to as *casework aides* or assistants, may work directly with clients. They may help clients locate and obtain adequate housing, find jobs, or counsel parents about their children's dress and appearance. Casework aides serve as advocates for clients by going with them to clinics to insure that they receive needed medical care or by helping them effectively communicate their needs to institutions that provide educational or welfare services.

Homemaker aides help women improve their skill in shopping, cleaning, sewing, budgeting, family health and hygiene, child care, and meal planning and preparation. They are assigned to a home for 1 or more days a week, or instruct groups of housewives at a community or neighborhood center.

An important facet of the homemaker aides' work is the actual demonstration of homemaker skills. Stressing the importance of regular-

ity and routine in the home, they set up a schedule of weekly activities. They get down to particulars of housekeeping by teaching homemakers how to clean stoves and refrigerators, prepare meals from leftovers, or recognize a bargain in inexpensive material for an attractive dress. They encourage homemakers to take advantage of cost-saving opportunities such as the barber school for haircuts, the thrift shop, surplus foods, and free recreation. In addition to teaching domestic skills, some homemaker aides also help housewives obtain needed social services.

Social service aides help care for children of working mothers at child development facilities and day care centers. They feed, entertain, and otherwise care for children who are usually too young to attend school. Under the direction of social workers and other professionals, they help children develop socially and prepare for elementary school. Aides also may teach children counting, arithmetic, art, music, and other subjects that stimulate their curiosity and ability to think. Social service aides also may transport elderly and handicapped persons who are not institutionalized to clinics for medical checkups or stores to purchase food, clothes, and other necessities.

Some outreach workers called *neighborhood workers* personally contact the residents of an area to explain and discuss agency services. They learn the needs of individuals and families and refer routine cases to a counselor or to the appropriate community service agency. They report more difficult problems to a supervisor. Neighborhood workers may inform residents about job openings, available housing, job training opportunities, and public services. On a broader scale, they assist in the organization of block and other neighborhood groups to conduct programs that benefit the neighborhood, foster a sense of community responsibility among residents, and encourage participation in the anti-poverty programs of social service agencies. They also may assist in routine neighborhood surveys and counts, keep records, and prepare reports of their activities for the supervisor.

Employment aides, another type of outreach worker, actively seek out the disadvantaged and help prepare them for employment through special training and counseling. Working in neighborhood centers or mobile units, they locate candidates for available jobs and training programs by contacting unemployed residents in pool rooms, laundromats, and street corners. They give the unemployed information about the services of the local State Employment Service office, available job and training opportunities, and help them fill out the necessary application forms. After clients are employed, aides maintain contact to help workers adjust to the new work environment and to iron out minor difficulties.

Apart from these more specific duties, the single most useful function of the social service aide is to be a friendly listener who is available when needed to offer encouragement and counsel.

Places of Employment

About 100,000 people worked as social aides in 1972; about four out of five were women. Most work in the inner cities of large metropolitan areas.

More than half of the social service aides work for government departments and agencies primarily on the state and local level. They work for community and neighborhood organizations and centers, welfare and social service agencies, residential welfare facilities for children or adults, and rehabilitation agencies serving the blind, disabled, and otherwise disadvantaged.

Training, Other Qualifications, and Advancement

Graduation from high school generally is not required for social service aide jobs. Employers do not always look for the most highly skilled applicants. An individual's need for work, as well as his potential for upgrading his skills and making a useful contribution to the agency, often is considered.

People seeking jobs as social service aides should get along well with people, especially the disadvantaged, and be able to work as part of a team. They should be tactful, courteous, and possess leadership qualities.

Homemaker aides should be housewives and mothers who have demonstrated competence in managing a home and rearing children. Outreach workers assigned to Puerto Rican or Mexican-American communities should speak and understand Spanish. Some social service aide jobs require typing skills.

Most employers emphasize the development of career ladders with opportunities for advancement through a combination of on-the-job training, work experience, and further education. Aides usually are trained on the job from one to several months. Those without high school diplomas often receive classroom instruction to help them pass a high school equivalency examination. Entry level positions as employment aides can lead to a job as an employment interviewer, and, after special training, to employment counselor. Employing agencies frequently pay part of the cost of further education for social services aides.

Employment Outlook

Employment of social service aides is expected to grow very rapidly through the mid-1980's. Many opportunities are expected for part-time work. Most openings will be due to the need to replace aides who die, retire, or transfer to other jobs.

Employment in this field will stem from population growth, coupled with this country's continuing commitment to aid those who are disadvantaged, disabled, or unable to care for themselves. In addition, as social welfare services and programs expand, social service aides increasingly will be used for much of the routine and less responsible work now done by professional personnel.

Earnings and Working Conditions

Social service aides who worked full-time earned salaries ranging from $5,000 to $8,000 a year in 1972, according to a survey by the Child Welfare League of America. The Federal Government paid beginning social service aides salaries of from $4,798 to $6,128 depending upon their education and prior work experience; experienced aides earned as much as $12,373. Many aides work part-time and earn less.

Although they work much of the time in offices of social service departments and agencies, they may frequenly visit the homes of clients or offices of other social service agencies, hospitals, and business establishments. Aides often must work evenings or weekends when clients can be reached.

Sources of Additional Information

Information on requirements for social service aide jobs is available from city, county, or State departments of welfare or social service, community or neighborhood development agencies, and local offices of the State Employment Service.

SOCIAL WORKERS

(D.O.T. 195.108, .118, .168, and .208, .228)

Nature of the Work

The ability of people to live in harmony with their neighbors often is hampered by social problems that range from an individual's personal problems to social unrest within a group or community. These problems aggravated by the growing complexity of society, have greatly increased the need for social services. Social workers assist individuals, families, and groups in using these services to solve their problems.

Many social service programs are designed to meet the needs of individuals or families, some emphasize large groups, and still others are directed mainly to the community's social welfare. The three basic approaches to social work are casework, group work, and community organization. The approach used in tackling a social problem is usually determined by the nature of the problem and the time and resources available. Social workers sometimes combine two or all three approaches.

In casework, social workers identify the problems of individuals and families through interviews. They aid in understanding and solving problems and help secure needed services, education, and job training. Through group activities, social workers help people to understand themselves and others better, to overcome racial and cultural prejudices, and to work with others in achieving a common goal. They plan and conduct activities for children, adolescents, adults, and older persons in a variety of settings such as settlement houses, hospitals, homes for the aged, and correctional institutions. In community organization, social workers organize political,

civic, religious, business, and union groups to combat social problems through community programs. They help plan and develop health, housing, welfare, and recreation services for a neighborhood or larger area. They often coordinate existing social services and organize fund raising for community social welfare activities.

The majority of social workers provide social services directly to individuals, families, or groups. However, a substantial number are executives, administrators, or supervisors. Others are college teachers, research workers, consultants, or private practitioners.

Public and voluntary agencies have a variety of social work programs to meet specific needs, as suggested by the following descriptions of the principal areas of social work.

Social workers in family service positions in State and local welfare offices and voluntary agencies provide counseling and social services that strengthen personal relationships and help clients to improve their social functioning. They also advise their clients on the constructive use of financial assistance and other social services.

Social workers in child welfare positions in government and voluntary agencies work to improve the physical and emotional well-being of deprived and troubled children and youth. They advise parents on child care and child rearing, counsel children and youth with social adjustment difficulties, arrange homemaker services during a mother's illness, institute legal action for the protection of neglected or mistreated children, provide services to unmarried parents, and counsel couples who wish to adopt children after making appropriate case evaluations and home studies, they may place children in suitable adoption or foster homes or in specialized institutions.

Social workers in schools aid children whose unsatisfactory school behavior is related to their social problems. These workers consult and work with parents, teachers, counselors, and other school personnel to identify and solve problems that hinder satisfactory adjustment.

Social workers in medical and psychiatric settings such as hospitals, clinics, health and mental health agencies, rehabilitation centers, and public welfare agencies aid patients, their families and communities with social problems accompanying illness, recovery, and rehabilitation. As members of medical teams, they help patients respond to treatment and guide them in their readjustment to their homes, jobs, and communities. (The related occupation of rehabilitation counselor is discussed in a separate statement.)

Probation and parole officers and other social workers engaged in correctional programs help offenders and persons on probation and parole readjust to society. They counsel on social problems encountered in relation to their return to family and community life. Probation and parole officers also may help secure necessary education, training, employment, or community services.

Places of Employment

About 185,000 social workers were employed in 1972; nearly two-thirds of them were women. Federal, State, county and city government agencies employ about two-thirds of all social workers. Most of the remainder work for voluntary or private agencies, schools, hospitals, and other medical establishments. Although employment is concentrated in urban areas, many work with disadvantaged families in rural areas. A small number of social workers—employed by the Federal Government and the United Nations

or one of its affiliated agencies—serve in other parts of the world as consultants, teachers, or technicians and establish agencies, schools, or assistance programs.

Training, Other Qualifications, and Advancement

A bachelor's degree, preferably in social welfare or social work, generally is the minimum educational requirement for beginning jobs in social work. In several specialized areas, a master's degree in social work is required. For teaching positions, a master's degree in social work is also required, and a doctorate is preferred. A graduate degree and experience in social work, as well as training in social science research methods, are required for research work. In most States, applicants for employment in a government agency must pass a written examination.

Two years of specialized study and supervised field instruction are needed to earn a master's degree in social work. In 1971, 81 colleges and universities offered accredited graduate degree programs in social work. For admission to these schools, a student must have a bachelor's degree, preferably including courses in economics, history, political science, psychology, social work, sociology, and social anthropology.

Many scholarships and fellowships are available for graduate education. More than half of the full-time students in graduate schools receive some type of financial aid either from the schools or employing agencies. Some social welfare agencies, both voluntary and public, offer plans whereby workers are granted "educational leave" to obtain graduate education. The agency may pay the expenses or a salary, or both.

Social workers should be emotionally mature, objective, sensitive, and possess a basic concern for people and their social problems. They must be able to handle responsibility and work indepentently, form and sustain good working relationships, and encourage social adjustment in others.

Students should obtain as much related work experience as possible during high school and college to determine whether they have the interest and capacity for professional social work. They may do volunteer, part-time, or summer work in places such as camps, settlement houses, hospitals, community centers, or social welfare agencies. Some voluntary and public social welfare agencies hire students for jobs in which they assist social workers.

Employment Outlook

Employment opportunities for persons having bachelor's degrees in social welfare or related fields should be favorable through the remainder of the 1970's. Competition may increase in the 1980's, however, if the number of social work graduates increases along with growth of all college graduates. The outlook for graduates of master's degree programs in social work is expected to continue to be very good through the mid-1980's. Women with social work experience should have favorable prospects for part-time work.

The very rapid growth in employment of social workers that is expected through the mid-1980's will stem primarily from anticipated expansion in programs to provide services to disadvantaged individuals and groups. The occupational structure of the economy is expected to continue to change and create severe problems for many unskilled workers and others whose jobs have been replaced by machines. In addition, social change will continue to affect family life. The increasing population of the very young and the very old, the age groups most in need of social work services, also is espected to contribute to the demand for social workers.

Earnings and Working Conditions

Social worker earnings are generally above the average earnings of all nonsupervisory workers on private non-farm payrolls. Various State agencies paid social caseworkers with bachelor's degrees average starting salaries of about $6,900 a year, according to an early 1972 survey of selected occupations by the Public Personnel Association. Salaries of casework supervisors in State agencies ranged from $8,800 for those having little experience to about $11,500 for those having considerable experience. Salaries of psychiatric social workers averaged from $8,700 to $10,800; those of probation and parole officers averaged from about $7,800 to $9,900.

Social workers employed by cities and urban counties tend to average $1,000 to $2,000 more than those paid by State agencies, in many instances according to the survey cited.

Persons having Masters' degrees in social work received starting salaries of about $10,000 in 1972, according to a survey by the National Association of Social Workers. Those having experience earned median salaries of about $13,000. Private practitioners and those in administrative, teaching, and research jobs earned more than $16,000.

Persons having a bachelor's degree in social work or 3 years of appropriate work experience hired by the Federal Government in 1972, began as social service assistants and received $7,319 a year. Master's degree graduates of accredited schools of social work started at $9,053 a year; those having professional social

work experience could begin at a higher salary. Salaries of journeymen social workers employed by the Federal Government ranged from $13,309 to $17,305.

Most social workers have a 5 day week, but many work only part-time. In some social work agencies, however, the nature of the work requires evening and weekend work, for which social workers usually receive compensatory time off. Virtually all social work agencies provide fringe benefits such as paid vacations, sick leave, and retirement plans.

Sources of Additional Information

For information about career opportunities in the various fields of social work, contact:

National Association of Social Workers, 15th and H St. NW., 600 Southern Building, Washington, D.C. 20005.

Information on accredited graduate and undergraduate college programs in social work is available from:

Council on Social Work Education, 345 East 46th St., New York, N.Y. 10017.

ART, DESIGN, AND COMMUNICATIONS RELATED OCCUPATIONS

Creativity and the ability to communicate ideas are prerequisites for work in the art, design, and communications related occupations. For example, an architect's blueprint is the embryo of a building; floral designers express a mood of love, sympathy, or other emotion in a flower arrangement; and actors project a character on the stage or screen for the enjoyment of their audiences. Newspaper reporters communicate newsworthy events to their reading audiences; dancers express emotion, mood, or thought through physical movements; and photographers capture an emotion or idea through camera angle, lighting, and the flick of a shutter.

This section of the *Handbook* describes in detail the occupations that require creative and communicative talents: the Performing Arts—actors, dancers, singers, and musicians; Communications Related Occupations—interpreters, news reporters, and radio and T.V. announcers; and the Design Occupations—architects, commercial artists, urban planners, and six other related occupations.

PERFORMING ARTISTS

The performing arts include music, acting, singing, and the dance. In these fields, the number of talented persons seeking employment generally greatly exceeds the number of full-time positions available. As a result, many performers supplement their incomes by teaching, and others work much of the time in different types of occupations.

The difficulty of earning a living as a performer is one fact young persons should remember when they consider such a career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists usually must spend many years in intensive training and practice before they are ready for public performances. They need not only great natural talent but also determination, a willingness to work long and hard, and an overwhelming interest in their chosen field.

The statements which follow this introduction give detailed information on musicians, singers, actors, and dancers.

ACTORS AND ACTRESSES

(D.O.T. 150.028 and 150.048)

Nature of the Work

Making a character come to life before an audience is a job that has great glamour and fascination. It also is hard and demanding work that requires special talent and involves many difficulties and uncertainties.

Only a few actors and actresses achieve recognition as stars on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who frequently are cast in supporting roles. However, most actors and actresses struggle for a toehold in the profession, and are glad to pick up parts wherever they can.

New actors generally start in "bit" parts, where they speak only a few lines. If successful, they may progress to larger, supporting roles, of which there are several in most stage, television, and screen productions. They also may serve as understudies for the principals. If a leading player misses a performance the understudy has a chance to demonstrate his acting ability.

Actors who prepare for stage, screen, and television roles rehearse many hours. They must memorize their lines and know their cues.

In addition to the actors with speaking parts, "extras," who have no lines to deliver, are used in various ways in almost all motion pictures and many television shows and theatre productions. In "spectacular" productions, a large number of extras take part in crowd scenes.

Some actors find alternative jobs

as dramatic coaches or become directors of stage, television, radio, or motion pictures productions. A few teach in schools of acting or in the drama departments of colleges and universities.

Places of Employment

About 9,000 actors and actresses work in the United States. The principal areas of employment for actors are stage plays, motion pictures (including films made especially for television), industrial shows and commercials.

In the winter, most employment opportunities on the stage are in New York and other large cities. In the summer months, stock companies in suburban and resort areas throughout the Nation provide many opportunities for employment. In addition, many cities now have "little theatres," repertory companies and dinner theatres, which provide opportunities for local talent as well as for professional actors and actresses from New York and other centers. Plays that go "on the road" (move from city to city) are normally produced in New York City with cast selected there.

Employment in motion pictures and film television is essentially centered in Hollywood and New York City, although a few studios are located in Miami, and other parts of the country. In addition, many films are shot on location, providing employment for nonprofessionals who live in the area as "extras." An increasingly large number of American-produced films are being shot in foreign countries. In television, most opportunities for actors are at the headquarters of the major networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television stations occasionally employ actors.

Training, and Other Qualifications

Young persons who aspire to acting careers should take part in high school and college plays, or work with little theatres and other acting groups in their home towns to get as much acting experience as possible.

Formal training in acting is increasingly necessary. Such training can be obtained at special schools of the dramatic arts, located chiefly in New York, and in more than 1,600 colleges and universities throughout the country. College drama curriculums usually include courses in liberal arts, speech, pantomime, play production, and history of the drama, as well as practical courses in acting. From these, the student develops an appreciation of the great plays and a greater understanding of the roles he may be called on to play. Graduate degrees in the fine arts or in drama are needed for college teaching positions.

Acting demands patience and total commitment, since aspiring actors and actresses must wait for parts or filming schedules, work long hours, and often do much traveling. Flawless performances require long rehearsal schedules and the tedious memorizing of lines. The actor needs stamina to withstand the heat of stage or studio lights, or the adverse weather conditions which may exist "on location." Above all, young persons who plan to pursue an acting career must have talent and the creative ability to portray different characters. They must have poise, stage presence, and aggressiveness to project themselves to the audience. At the same time, the ability to follow directions is important.

In all media, the best way to start is to use local opportunities and to build on the basis of such experience. Many actors who are successful in local dramatic productions eventually try to appear on the New York stage. Inexperienced actors usually find it extremely difficult to obtain employment in New York or Hollywood. The motion picture field is especially difficult to enter, and employment often results from previous experience on Broadway.

To become a movie extra, one must usually be listed by Central Casting, a no-fee agency which works with the Screen Extras Guild and supplies all extras to the major movie studios in Hollywood. Applicants are accepted only when the number of persons of a particular type on the list—for example, athletic young men, old ladies, or small children—is below the foreseeable need. In recent years, only a very small proportion of the total number of applicants have succeeded in being listed. Extras have very little, if any, opportunity to advance to speaking roles in the movies.

The length of an actor's working life depends largely on his skill and versatility. Great actors and actresses can work almost indefinitely. On the other hand, employment opportunities become increasingly limited by middle age, especially for those who become typed in romantic, youthful roles.

Employment Outlook

Overcrowding has existed in the acting field for many years and it is expected to persist. In the legitimate theater and also in motion pictures, radio, and television, numbers of job applicants greatly exceed the jobs available. Moreover, many actors are employed in their profession for only a small part of the year.

The development of motion pictures and TV has greatly reduced employment opportunities for actors in the theater. Although a motion picture production may use a very large number of actors, they are employed only during filming and the

films are widely distributed and may be used for years. Also, the increasing number of American-produced films being shot in foreign countries will reduce employment opportunities for American actors. The number of filmed TV dramas and commercials using actors is increasing, but not enough to offset the decline in other media. Moreover, television stations often broadcast "taped" dramas rather than live productions, and, like motion picture films, these tapes may be widely distributed and used many times.

One possibility for future growth in the legitimate theater lies in the establishment of year-round professional acting companies in cities. The number of communities with such acting groups is growing. The recent growth of summer and winter stock companies, repertory companies, and dinner theaters also has increased employment opportunities. Some increases also may be likely in the employment of actors on television in response to expansion of the Public Broadcasting System, UHF stations, and cable TV (pay TV). The development and wider use of video cassettes also may result in some employment opportunities.

In the acting field as a whole, however, employment is expected to change little through the mid-1980's. The number of persons who want to enter the profession is expected to outnumber employment opportunities. Even highly talented young people are likely to face stiff competition and economic difficulties.

Earnings and Working Conditions

Actors and actresses employed in the legitimate theater belong to the Actors' Equity Association. If employed in motion pictures, including television films, they belong to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc. If employed in television or radio, they belong to the American Federation of Television and Radio Artists (AFTRA). These unions and the show producers sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. Each actor also enters into a separate contract which may provide for higher salaries than those specified in the basic agreement.

The minimum weekly salary for actors in Broadway productions was about $197.50 in 1972. Those in small "off-Broadway" theaters received a minimum of $125 a week. For shows on the road, the minimum rate was about $274.50 a week. (All minimum salaries are adjusted upward automatically, by union contract, commensurate with increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index).

Motion picture actors and actresses earned a minimum daily rate of $140, or $483 for a five day week, in 1972. For extras, the minimum rate was $35.65 a day. Actors on network television received a minimum program fee of about $180 for a single half-hour program and 10 hours of rehearsal time; actors on radio received about $50 for a half-hour performance, including one rehearsal hour. Because of the frequent periods of unemployment, characteristic of this profession, annual earnings may be low for many lesser-known performers. In all fields, many well-known actors and actresses have salary rates above the minimums. Salaries of the few top stars are many times the figures cited.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. The basic workweek after the opening of a show is 36 hours, including 12 hours for rehearsals. Before the openings, however, the workweek usually is longer to allow enough time for rehearsals. Evening work is, of course, a regular part of a stage actor's life. Rehearsals may be held late at night and on weekends and holidays. When plays are on the road, traveling over the weekend often is necessary.

Most actors are covered by a pension fund and a growing number have hospitalization insurance to which their employers contribute. All Equity and AFTRA members have paid vacations and sick leave. Most stage actors get little if any unemployment compensation solely from acting since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when a show closes, they often have to take any casual work obtainable while waiting for another role.

Sources of Additional Information

Information on colleges and universities and conservatories which offer a major in drama is available from the American Educational Theater Association, 1317 F Street, NW., Washington, D.C. 20004.

DANCERS

(D.O.T. 151.028 and 151.048)

Nature of the Work

Dancing is an ancient and worldwide art that has many different forms. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk dances, and in other popular kinds of dancing. In classical ballet, movements are based

on certain conventional or styled "positions," and women dance "en pointe" (on the tips of their toes). In the modern dance, movements are more varied but are nonetheless carefully planned and executed to follow a pattern.

In dance productions, performers most often work as a corps de ballet (chorus). However, a group of selected dancers may do special numbers, and a very few top artists do solo work.

Many dancers combine their stage work with full-time teaching in schools of the dance or in colleges and universities. The few dancers who become choreographers create new ballet or dance routines. Others are dance directors who train dancers in new productions.

(This statement does not include instructors of ballroom and other social dancing.)

Places of Employment

About 4,000 dancers worked on the stage, screen, and television in the United States in 1972. Many more teach at schools of the dance and in other schools and colleges. A few teachers, trained in dance therapy, work in mental hospitals. About 90 percent of all dancers are women, but in some types of dance, particularly ballet and modern, women constitute only about one-half of the performers.

Dancing teachers are located chiefly in large cities, but many smaller cities and towns have schools of the dance. New York City is the hub for the majority of performing dancers; others are situated in most large cities.

Training and Other Qualifications

Serious training for a dancing career traditionally begins by age 12 or earlier. For example, girls who wish to become ballet dancers should begin taking lessons at the age of 7 or 8. From 2 to 3 years of prior preparation is needed before the young girl should start dancing "en pointe." Professional training in ballet typically takes from 10 to 12 lessons a week for 11 or 12 months in the year and many additional hours of practice. The length of the training period depends on the student's ability and physical development, but most dancers have their professional audition by age 17 or 18.

The selection of a professional dancing school is important for two reasons. First, the school must use expert judgment in setting the pace of training, since too early and too severe exercise can permanently damage the legs and feet. Second, the school's connections with producers may help the students obtain employment.

Because of the strenuous training in professional schools, a student's general education may not exceed the legal minimum. However, a dancer's education should include a study of music, literature, and history to help in the interpretation of dramatic episodes and music.

About 200 colleges and universities confer bachelor's degrees on students who have majored in physical education and concentrated on the dance; majored in a dance; or majored in a dance program to prepare students as professional dance artists. Some schools also give graduate degrees.

A college education is an advantage in obtaining employment as a teacher of professional dancing or

choreography. However, dancers who postpone their first audition for openings in classical ballet until graduation may compete at a disadvantage with younger dancers.

Professional schools usually require teachers to have experience as a performer; colleges and conservatories generally require graduate degrees, but experience as a performer often may be substituted. Maturity and a broad educational background also are important.

The dancer's life is one of rigorous practice and self-discipline. Good health and physical stamina are necessary, both to keep in good condition and to follow the rugged travel schedule imposed on many dancers.

Height and body build should not vary much from the average. Good feet and normal arches also are required. Above all, one must have a natural aptitude for dancing, and a creative ability to express oneself through dance.

Seldom does a dancer perform unaccompanied. Therefore, young persons who consider dancing as a career should be able to function as part of a team. They also should be prepared to face the anxiety of unstable working conditions brought on by show closings and audition failures.

Except for outstanding stars, women past 30 are rarely hired by ballet companies, and women past 25 are rarely hired for Broadway shows unless they have had experience in such productions. Men in ballet and men and women in modern dance can usually work longer than other dancers. After the employable age for performers has passed, some dancers teach in colleges or conservatories or establish their own schools. The few who become choreographers or dance directors can continue to work as long as persons in other occupations.

Employment Outlook

Opportunities in this field will be limited both by the small number of full-time jobs available and the relatively large supply of applicants. The supply of trained dancers has exceeded the demand for many years. The irregular nature of employment is expected to persist despite recent union-management steps to guarantee full or near full employment each year.

Adversely affecting the demand for dancers is the decline in the number of stage productions because of competition from motion pictures and television and foreign competition (especially in ballet). Few stage shows run more than 26 weeks and many "fold" after the first week. On the other hand, more industrial exhibitions, auto shows, and state fairs are being produced and a growing trend toward using professional dancers at these events is evident. Also, some new professional dance companies are being developed and television will offer a first employment opportunities. Civic and community dance groups are increasing in number, and opportunities for dancers will expand as these develop into professional groups. Nevertheless, employment opportunities for dance performers are expected to remain limited, and most of the openings for dancers in the years ahead will stem from the need to replace those who leave the field.

Dancers who have the personal and educational qualifications for teaching will have more employment opportunities than those trained only as performers. The growing interest in the dance as one of the fine arts is contributing to the demand for teachers of dancing.

Earnings and Working Conditions

Dancers who perform professionally are members of one of the unions affiliated with the Associated Actors and Artists of America (AFL-CIO). Dancers who perform in opera ballet, classical ballet, and the modern dance belong to the American Guild of Musical Artists, Inc.; those who perform on live television belong to the American Federation of Television and Radio Artists; those who perform in films, T.V., and other forms of motion pictures belong to the Screen Actors Guild or the Screen Extras Guild; and those who appear in musical comedies join Actors' Equity Association. Dancers also may be members of other unions, depending upon the fields in which they perform. Minimum salary rates, hours of work, and other conditions of employment are specified in basic agreements signed by the unions and the producers. The separate contract signed by each dancer with the producer of the show may be more favorable than the basic agreement regarding salary, hours of work, and working conditions.

The minimum salary for dancers in ballet and other stage productions was about $170 a week in 1972. The single performance rate is $68.00 for a solo dance and $37.00 per dancer for a group. Dancers on tour received an allowance of $15 a day in 1972, to defray the cost of room and board. The employer pays the cost of transportation. If a dancer signs a contract for a brief appearance in a performance on television or a few days' work in a movie, the minimum rate is higher, relative to time worked. However, this difference is offset by the brevity of the engagement and the long period likely to be spent waiting for the next one. A few performers, of course, have much higher salaries.

Some dancers qualified to teach in schools of the ballet combine this work with engagements as perform-

ers. Many more dancers have to supplement their incomes by other types of work.

Salaries of teachers in the technical schools of the ballet vary with the location and prestige of the school. Dance teachers in college and universities are paid on the same basis as other faculty members. (See statement on "College and University Teachers.")

The normal workweek is 30 hours (five hours per day maximum) spent in rehearsals and matinee and evening performances. Extra compensation is paid for additional hours worked. Most stage performances take place, of course, in the evening, and rehearsals may require very long hours, often on weekends and holidays. When shows are on the road, weekend travel often is required.

Dancers are entitled to some paid sick leave and various health and welfare benefits provided by their unions, to which the employers contribute.

Sources of Additional Information

Information on colleges and universities and conservatories of music which give a major in the dance or some courses in the dance, as well as details on the types of courses and other pertinent information is available from the American Association for Health, Physical Education and Recreation, a division of the National Educational Association, 1201 16th Street, NW., Washington, D.C. 20036.

MUSICIANS

(D.O.T. 152.028 and 152.048)

Nature of the Work

Professional musicians—whether they play in a symphony orchestra, dance band, rock group, or jazz combo—generally have behind them many years of formal or informal study and intensive practice. As a rule, musicians specialize in either popular or classical music; only a few play both types professionally.

Musicians who specialize in popular music usually play the trumpet, trombone, clarinet, saxophone, organ, or one of the "rhythm" instruments—the piano, string bass, drums, or guitar. Dance bands play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, rock groups, and solo performers sometimes give concerts and perform on television.

Musicians who specialize in classical music play in symphonies, opera and theater orchestras, and for other groups that require orchestral accompaniments. The instruments played by most of these musicians are the strings, brass, and woodwinds. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music.

Many pianists accompany vocal, instrumental soloists, or choral groups or provide background music in restaurants or other places. Most organists play in churches; often they direct the choir. A few exceptionally brilliant musicians become well-known concert artists. They give their own concerts and appear as soloists with symphony orchestras. Both classical and popular musicians often make recordings, either individually or as members of a group.

A very high proportion of all musicians teach in the Nation's schools

and colleges. These teachers may be members of the faculty of music schools or conservatories or of colleges which offer instruction in instrumental and vocal music. Some are music teachers in elementary or secondary schools where they direct vocal and instrumental music programs, teach general classroom music appreciation, and give group instruction on an instrument. Private lessons are given by many teachers employed by school systems, and by performing musicians, either in their own studios or in pupil's homes.

A few musicians work in the field of music therapy in hospitals, and in music libraries.

Places of Employment

About 85,000 persons worked as

performing musicians in 1972. Many thousands more taught in elementary and secondary schools and in colleges and universities. Moreover, almost every town and city has at least one private music teacher.

Most professional musicians who perform work in cities where the Nation's entertainment and recording activities are concentrated, such as New York, Chicago, Los Angeles, Nashville, Miami Beach, and New Orleans. Many perform with one of the 29 major symphonies, 80 metropolitan, or 1,100 community orchestras. Dance bands and civic orchestras also are located in many communities, although in the smaller towns, their members usually are part-time musicians with other regular jobs.

In addition to the people primarily employed as musicians or music teachers, thousands of qualified instrumentalists have other full-time jobs and only occasionally work as musicians. Most of these part-time musicians belong to dance bands, that are hired to play at private parties or for special occasions. Others, with a background in classical music, play occasionally in an orchestra, become conductors or composers, or do some part-time teaching.

Training and Other Qualifications

Most people who become professional musicians begin studying an instrument at an early age. To achieve a career as a performer or as a music teacher, young people need intensive training—either through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. They need to acquire not only great technical skill but also a thorough knowledge of music, and they must learn how to interpret music. Before a young person can qualify for advanced study in a music conservatory or in a college or university school of music, an audition frequently is necessary. Many teachers in these schools are accomplished artists who will train only promising young musicians.

More than 660 conservatories of music and college and university schools of music offer a bachelor's degree program in music education. Students who complete these programs can qualify for the State certificate required for elementary and secondary school positions. About 400 conservatories and collegiate music schools accredited by the National Association of Schools of Music award the degree of bachelor of music to students who major in instrumental or vocal music. Both of these programs provide not only training in performance but also a broad background in musical history and theory, together with some liberal arts courses. Advanced degrees usually are required for college teaching positions, but exceptions may be made for especially well-qualified artists.

Musicians who play jazz and other popular music must have an understanding of and feeling for that style of music, but skill and training in classical styles may expand their employment opportunities. As a rule, they take lessons with private teachers when young, and seize every opportunity to play in amateur or professional performances. Some groups of young people form their own small dance bands or rock groups. As they gain experience and become known, the players may have opportunities to audition for other local bands, and still later, for the better known bands and orchestras.

Young persons who consider careers in music should have both musical talent and creative ability. They also should have poise and stage presence to face large audiences. Since quality of performance requires constant study and practice, self-discipline is vital. Moreover, musicians who do concert and nightclub engagements, must have physical stamina because of constant travel and rugged time schedules that often include long night hours.

Employment Outlook

The music performance field is expected to remain overcrowded through the mid-1980's. Opportunities for concerts and recitals are not numerous enough to provide adequate employment for all the pianists, violinists, and other instrumentalists qualified as concert artists. Competition usually is keen for positions which afford some stability of employment such as jobs with major orchestras and teaching positions in conservatories and colleges and universities. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been more than sufficient to give instruction to all the young persons seeking lessons, and probably will continue to be. Although many opportunities are expected for single and short-term engagements, playing popular music in night clubs, theaters, and other places, the supply of qualified musicians who seek such jobs is likely to exceed demand. On the other hand, first-class, experienced accompanists and well-trained, outstanding players of stringed instruments are likely to remain relatively scarce.

Employment of music performers is expected to increase slightly through the mid-1980's. Although the number of civic orchestras in smaller communities has been growing steadily, many of these orchestras provide only part-time employment for musicians who work chiefly as teachers or in other occupations.

Moreover, openings created by these orchestras have been more than offset by the decline in opportunities for musicians in theater, radio, and motion pictures. The increased use of recorded music has lead to the decline of opportunities in these areas. Additional employment opportunities are expected from the expanded use of cable TV (pay TV) and wider use of video cassettes.

The employment outlook in music education for people who are qualified as teachers as well as musicians is better than for those qualified as performers only. However, the supply of music teachers in the Nation's schools is adequate—a situation which is likely to continue through the 1980's.

Earnings and Working Conditions

The amount received for a performance by either classical or popular musicians depends to a large extent on their professional reputations. Musicians who were members of 1 of the 29 major symphony orchestras in the United States received minimum salaries that ranged from about $170 to $340 a week in 1972, according to the American Symphony Orchestras League, Inc. Seven orchestras—New York, Boston, Philadelphia, Cleveland, Cincinnati, Houston, and Chicago—have year-round seasons (52 weeks) and minimum salaries ranging from $10,000 to $17,700. The other major symphony orchestras have seasons ranging from 34 to 54 weeks.

Musicians who played on half-hour TV shows received a minimum of $72.45 in 1972 (includes 2-hour rehearsal time). The minimum scale for recording is $90 for a 15-minute tape (3 hours actual taping time).

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers. (See statements on Elementary and Secondary School Teachers elsewhere in the *Handbook*.) Many give private music lessons to supplement their earnings. However, earnings are uncertain and vary according to the musician's reputation, the number of teachers and students in the locality, and the economic status of the community.

Musicians customarily work at night and on weekends. They also must spend considerable time in practice and in rehearsal.

Many musicians, primarily those employed by symphony orchestras, work under master wage agreements, which guarantee a season's work up to 52 weeks. Musicians in other areas, however, may face relatively long periods of unemployment between jobs. Thus, the overall level of their earnings generally is lower than that of many other occupations. Moreover, they do not usually work steadily for one employer. Consequently, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay.

Most musicians who play professionally belong to the American Federation of Musicians (AFL-CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL-CIO).

Sources of Additional Information

For information about wages, hours of work, and working conditions for professional musicians, contact:

American Federation of Musicians (AFL–CIO), 641 Lexington Ave., New York, N.Y. 10022.

Information about the requirements for certification of organists and choir masters is available from:

American Guild of Organists, 630 Fifth Avenue, New York, N.Y. 10020.

A list of accredited schools of music is available from:

National Association of Schools of Music, One Dupont Circle, NW., Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association, 1201 16th St., NW., Washington, D.C. 20036.

SINGERS

(D.O.T. 152.028 and .048)

Nature of the Work

Professional singing is an art that usually requires not only a fine voice but also a highly developed technique and a broad knowledge of music. A small number of singing stars make recordings or go on concert tours in the United States and abroad. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as concert soloists in oratorios and other types of performances. Some singers also become members of opera and musical comedy choruses or other professional choral groups. Popular music singers perform in musical shows of all kinds—in the movies, on the stage, on radio and television, and in nightclubs and other entertainment places. The best known popular music singers make and sell many recordings.

Since most singers of both classical and popular music have only part-time or irregular employment they often have full-time jobs of other types and sing only in the evenings or

on weekends. Some give private voice lessons. A number of singers teach general music courses and choruses in elementary and secondary schools. Others give voice training or direct choral groups in churches, in music conservatories or in colleges and universities.

Places of Employment

About 36,000 persons worked as professional singers in 1972. Opportunities for singing engagements are mainly in New York City, Los Angeles, Las Vegas, San Francisco, Dallas and Chicago—the Nation's chief entertainment centers. Nashville, Tennessee, a major center for country and western music, is one of the most important places for employment of singers for "live" performances and recordings. Singers who teach music in elementary and secondary schools, colleges, universities, and conservatories of music are employed throughout the country. Many singers work part-time, chiefly as church singers and choir masters.

Training and Other Qualifications

Young persons who want to perform professionally as singers should acquire a broad background in music, including its theory and history. The ability to dance may be helpful, since singers are sometimes required to dance. In addition, those interested in a singing career should start piano lessons at an early age. As a rule, voice training should not begin until after the individual has matured physically, although young boys who sing in church choirs receive some training before their voices change. Moreover, because of the work and expense of voice training which often continues for years after the singer's professional career has started, a prospective singer must have great determination. An audition before a competent voice teacher to decide whether professional training is warranted is also important.

Young people can prepare for careers as singers of classical music by enrolling in a music conservatory, or a school or department of music connected with a college or university, or by taking private voice lessons. These schools provide not only voice training, but other training needed to understand and interpret music, including music-related training in foreign languages and sometimes dramatic training. Upon completion of a 4-year course of study the graduate may be awarded either the degree of bachelor of music, bachelor of science or arts (in music), or bachelor of fine arts.

Young singers who plan to teach music in public elementary or secondary schools need at least a bachelor's degree with a major in music education and must meet the State certification requirements for teachers. Such training is available in over 660 colleges and universities throughout the country. College teachers usually are required to have a master's degree and sometimes a doctor's degree, but exceptions may be made for especially well-qualified artists.

Although voice training is an asset for singers of popular music, many with untrained voices have had successful careers. The typical popular song does not demand that the voice be developed to cover as wide a range on the musical scale as does classical music, and the lack of voice projection may be overcome by use of a microphone.

Young singers of popular songs may become known by participating in amateur and paid performances in their communities. These engagements may lead to employment with local dance bands or rock groups and possibly later with better known ones.

In addition to musical ability, perseverance, an outstanding personality, an attractive appearance, good contacts, and good luck often are required to achieve a singing career. Singers also must have physical stamina in order to adapt to rigorous time and travel schedules which often include working night hours.

Employment Outlook

The employment outlook for singers is expected to remain highly competitive through the mid-1980's, especially among popular singers. Many short-term jobs are expected

in the opera and concert stage, movies, theater, nightclubs, radio and television, dance bands, and other areas—but not enough to provide steady employment for all qualified singers. Singers who can meet State certification requirements may find postions as music teacher.

Employment of singers is expected to increase at a moderate rate through the 1980's. Recorded music has replaced the "live" singer on radio; television performances by singers are limited. However, the demand is growing for singers who record popular music and do commercials for both radio and television advertising. Additional employment opportunities are expected from the expanded use of cable TV (pay TV) and wider use of video cassettes.

A singing career is sometimes relatively short, since it depends on a good voice and public acceptance of the artists, both of which may be affected by age. Due to these circumstances, singers may be subject to unstable employment conditions and the pressure of unreliable financial circumstances.

Earnings and Working Conditions

Except for a few well-known concert soloists, opera stars, top recording artists of popular music, and some singers regularly employed by dance bands, the motion picture industry, and commercial advertising, most professional singers experience difficulty in obtaining regular employment and have to supplement their singing incomes by doing other types of work.

Singers generally work at night and on weekends. Work in the entertainment field is seasonal and few performers have steady jobs.

Singers who appear on 1/2 hour TV programs received a minimum of $192 in 1972. Singers in opera choruses received between $35-45 per performance.

Singers who perform professionally usually belong to a branch of the AFL–CIO union, the Associated Actors and Artists of America. Singers who perform on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or live television or who make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and nightclub field belong to the American Guild of Variety Artists; those who sing in musical comedy and operettas belong to the Actors' Equity Association; and those who sing in the movies belong to the Screen Actors Guild, Inc.

Sources of Additional Information

Information about accredited schools and departments of music is available from:

National Association of Schools of Music, One Dupont Circle, NW., Washington, D.C. 20036.

For information about music teaching in elementary and secondary schools contact:

Music Educators National Conference, The National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

DESIGN OCCUPATIONS

Good design can improve the appearance and usefulness of the products that we use and the places where we live. It also helps merchants to increase sales by improving the "eye appeal" of their product, showroom, or advertising.

Different design careers require varying levels of training and education. For example, floral designers may learn their duties on the job and do not need a high school diploma, but architects must have at least 5 years of college and professional education. Regardless of the amount of formal training they have, it is essential that people in design occupations have creativity and artistic talent, the ability to communicate ideas through their designs, and good business sense. Some design workers, such as displaymen and industrial designers, need manual dexterity for performing their duties.

Job opportunities in design occupations are expected to increase through the mid-1980's, because personal income and population are growing and the more affluent public is becoming more design conscious.

This chapter describes eight design occupations: architects, commercial artists, displaymen, floral designers, industrial designers, interior designers, landscape architects, and urban planners. (Other jobs that may require design skills—for example, engineers—are described elsewhere in the *Handbook*.)

ARCHITECTS

(D.O.T. 001.081)

Nature of the Work

Attractive buildings improve the physical environment of a community. But buildings also must be safe and allow people both inside and around them to properly perform their duties. Architects design buildings that successfully combine these elements of attractiveness, safety, and usefulness.

Most architects provide professional services to clients planning a building project. These services begin in the early stages of the project's development and continue until all work is completed.

The architect and client first discuss the purposes, requirements, and cost of a project, as well as any preference on design that the client may have. The architect then prepares a rough design drawing to show the scale and structural relationships of the building.

After making preliminary drawings and discussing them with the client, the architect develops a final design showing the floor plans and the structural details of the project. Architectural design requires many decisions. For example, in designing a school, the architect must decide on the amount of corridor and stairway space that students need to move safely and easily from one class to another; the type and arrangement of storage space, the location and size of classrooms, laboratories, lunchroom or cafeteria, gymnasium, and administrative offices. The design also must conform to local and State building codes, zoning laws, fire regulations, and other ordinances.

The architect then prepares working drawings showing the exact dimensions of every part of the structure and the location of plumbing, heating units, electrical outlets, and air conditioning. Architects also specify the project's building materials, construction equipment, and in some cases, the interior furnishings.

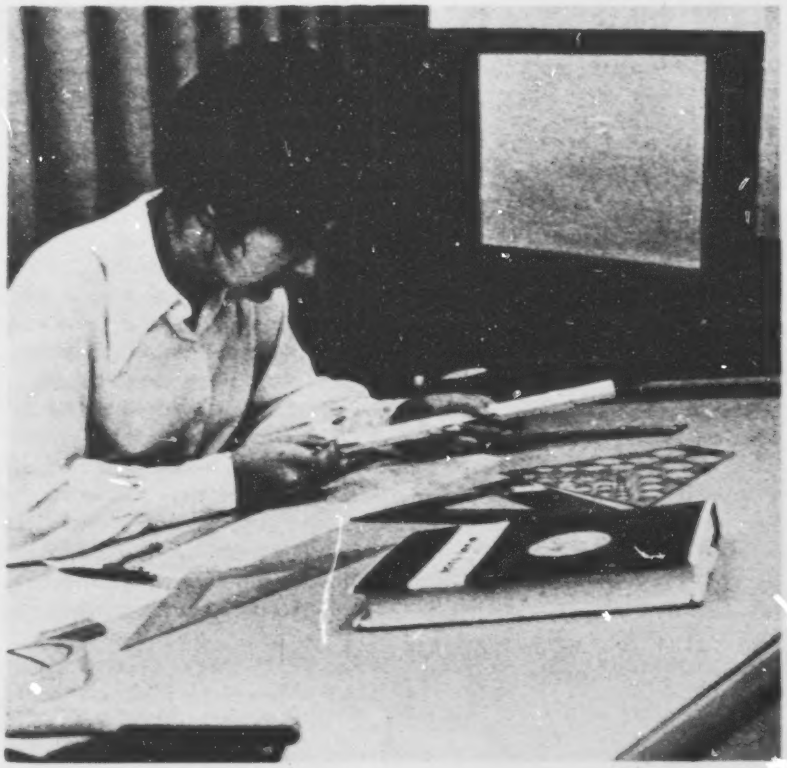
After all drawings are completed, the architect assists the client in selecting a contractor and in negotiating the contract. As construction proceeds, there are periodic visits to the building site to insure that the contractor is following the design and using the specified materials. The job is not completed until construction is finished, all required tests are made, and guarantees are received from the contractor.

Architects design a wide variety of structures such as houses, churches, hospitals, office buildings, and airports. They also design multi-building complexes for urban renewal projects, college campuses, industrial parks, and new towns. Besides designing structures, architects also may help in selecting building sites, preparing cost and land use studies, and long range planning for site development.

When working on large projects or for large architectural firms, architects often specialize in one phase of the work such as designing, drafting, specification writing, or administering construction contracts. This often requires working with engineers, urban planners, landscape architects, and other design personnel.

Places of Employment

About 37,000 registered (licensed) architects were employed in 1972;



fewer than 5 percent were women. Many other unlicensed architectural school graduates work in positions requiring knowledge of architecture, for example, as supervisory or sales personnel with firms in the building industry.

About two-fifths of all architects are self-employed, either practicing individually or as partners. Most of the others work for architectural firms. However, architects also work for builders, real estate firms, and for other businesses that have large construction programs. Some work for government agencies, often in city and community planning or urban redevelopment. About 1,400 architects work for the Federal Government, mainly for the Departments of Defense, Housing and Urban Development, Interior, and the General Services Administration.

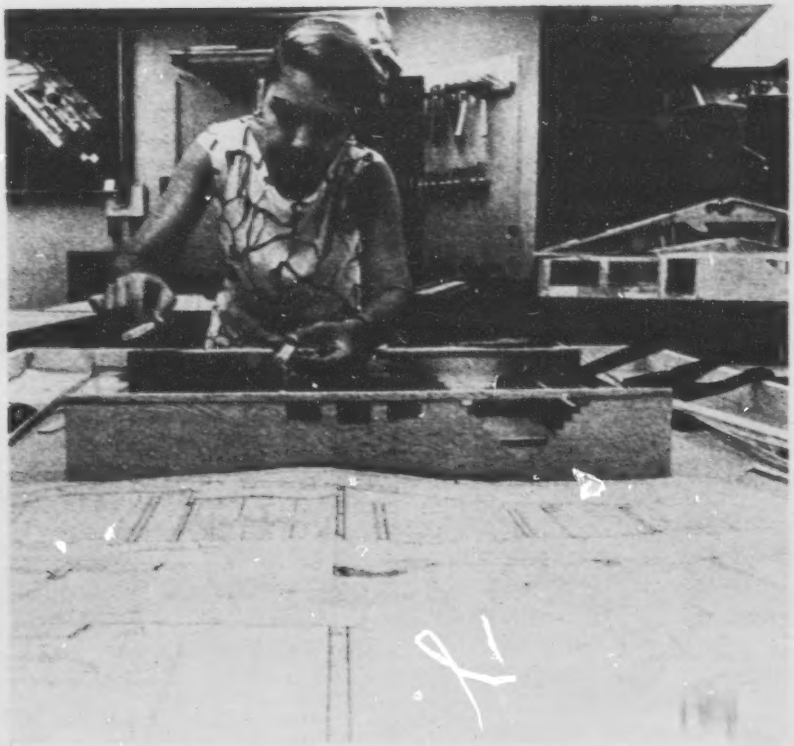
Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of architecture, mainly to insure that architectural work which may affect the safety of life, health or property is done by qualified architects. Requirements for admission to the 2-day licensing examination generally include graduation from an accredited architectural school, followed by 3 year's experience in an architect's office for those with a bachelor's degree, and 2 years of experience for those with a master's degree. As a substitute for formal training, most States accept longer periods of experience (usually 12 years) and successful completion of an equivalency test for admission to the licensing examination.

In 1972, 73 of the 89 schools offering professional degrees in architecture were accredited by the National Architectural Accrediting Board. Most of these schools offer a 5-year curriculum leading to a Bachelor of Architecture degree or a 6-year curriculum leading to a Master of Architecture degree. Many architectural schools also offer graduate education for those who already have their first professional degree. While such training is not essential for practicing architects, it is often desirable for those in research and teaching. Besides professional schools, many junior and community colleges offer 2-year programs in architecture that enable students to transfer to professional degree programs.

Most professional schools of architecture admit qualified high school graduates who meet the entrance requirements of the college or university with which the school is associated. As a general guideline, high school courses should include 4 years of mathematics and English, 3 years of science, 2 years of social sciences and a foreign language, and 1 year of history. A typical college architectural program includes courses in English, mathematics, chemistry, sociology, economics, a foreign language, as well as courses in architectural theory, design, graphics, engineering and urban planning.

Persons planning careers in architecture should be able to work independently, have a capacity for solving technical problems, and be inclined toward artistic creation. They also must be prepared to work in the competitive environment of business where leadership and ability to work with others are important. A person planning a career in architecture should be interested in social studies and have a strong desire to serve the public since architectural work affects people's life, health, and safety.



Architect constructs a model of building.

Working for architects or building contractors during summer vacations also is useful to gain knowledge of the practical problems of the profession.

New graduates usually begin as junior draftsmen in architectural firms, where they make drawings and models of structures under the direction of a registered architect. After several years of experience, they may advance to chief or senior draftsmen responsible for all major details of a set of working drawings and for supervising other draftsmen. Others may work as designers, construction contract administrators, or specification writers who prepare directions explaining the architect's plan to the builder. Employees who are particularly valued by their firm may become associates and receive, in addition to a salary, a share of the profits. Usually, however, the architect's goal is to establish a private practice.

Employment Outlook

Employment opportunities for architects are expected to be favorable through the mid-1980's. Several thousand openings will occur annually due to very rapid growth of the profession and to replace those who die, retire or transfer to other fields of work. Job opportunities are expected to increase most rapidly in new areas of work because of expanded need in business and government for people with professional design training. Openings for positions with established architectural firms and opportunities for starting a private practice are expected to grow more slowly.

A major factor contributing to the prospective rapid increase of employment for architects is the expected growth of nonresidential construction—the major area of work for architects. Architects will be required not only because of growth in nonresidential construction but also because of the increasing size and complexity of modern buildings. Homeowners' growing awareness of the value of architects' services and the increasing involvement of architects in planning and designing residential communities also should increase openings for architects. Since enrollments in college architectural programs are projected to rise in the years ahead, there should be additional requirements for architects to teach in colleges and universities.

Growing public concern about the quality of physical environments is expected to increase the demand for urban redevelopment and city and community environmental planning projects. This demand should create new job opportunities for architects in a wider range of fields than in the past. Some may be needed in research to develop new tools, materials, and systems for the construction industry. Still others may find employment in manufacturing and construction companies in areas such as design, sales, and administration. Government agencies also will provide opportunities for architects as they become more involved in environmental design and planning. (See statement on Urban Planners elsewhere in the *Handbook*.)

Earnings and Working Conditions

In private industry, starting salaries for new architectural school graduates are generally between $125 and $175 a week in 1972, according to the limited information available. Draftsmen with 2 or more years of experience earned between $160 and $260 a week, and job cap-

tains (supervisors), specification writers, and other senior employees usually earned between $245 and $330 a week. Senior employees often receive yearly bonuses in addition to their salaries.

Architects with well-established private practices generally earn much more than high-paid salaried employees of architectural firms. Although the range in their incomes is very wide, some architects with many years of experience and good reputations earn well over $25,000 a year. Young architects starting their own practices may go through a period when their expenses are greater than their incomes.

Depending on their college records, architects having a bachelor's degree and no experience could start in the Federal Government at either $150 or $185 a week in early 1973. Architects who have completed all requirements for the master's degree can start at $225 and those with a Ph.D. at $320 a week.

Most architects work in well-equipped offices and spend long hours at the drawing board. An architect sometimes has to work overtime to meet a deadline. The routine often is varied by interviewing clients or contractors, and discussing the design, construction procedures, or building materials of a project with other architects or engineers. Those involved in contract administration frequently work outdoors during inspections at construction sites.

Sources of Additional Information

General information about careers in architecture including a catalog of publications can be obtained from:

The American Institute of Architecture, 1735 New York Ave., Washington, D.C. 20036.

Information about schools of architecture and a list of junior colleges offering courses in architecture are available from:

The Association of Collegiate Schools of Architecture, Inc., 1735 New York Ave., Washington, D.C. 20036.

COMMERCIAL ARTISTS

(D.O.T. 141.031 and .081, 970.281 and .381, and 979.381)

Nature of the Work

A team of commercial artists often creates the artwork in newspapers and magazines and on billboards, brochures, catalogs, and television commercials. The art director supervises this team of artists with varying skills and specializations. He develops the artistic aspects of an advertising plan. He then turns it over to a layout man for further refinement. The layout artist constructs or arranges elements of the advertisement. He also selects and lays out illustrations and photographs, plans use of typography, and determines color and other elements of design. He then prepares a "rough visual" or sketch. After consulting with the director, he may change the visual and complete a more comprehensive layout for the customer.

A variety of specialists work with the layout man to turn out the finished product. These include *renderers*, who use magic markers to make rough drafts; *letterers*, who execute appropriate lettering either freehand or with mechanical aids; *illustrators*, who sketch and draw in more finished form; and *paste-up* and *mechanical men*, who cut and paste basic parts of the advertisement or other artwork by using a ruling pen and other drafting tools. Some workers, called *general boardmen*, spend nearly all their time at the drawing board performing many of these specializations. Apprentices help general boardmen or other specialists by doing routine jobs such as separating colors and cutting mats.

In a small office, the art director may perform the layout and board-

work with the aid of apprentices. In a large office, the art director develops concepts with the copywriter; sets standards; deals with clients; and purchases needed photographs, illustrations, lettering, and other art work from freelancers.

Advertising artists create the concept and artwork for a wide variety of items. These include direct mail advertising, catalogs, counter displays, slides, and film strips. They also design or lay out the editorial pages and features and produce or purchase the necessary illustrations or artwork. Some commercial artists specialize in producing fashion illustrations, greeting cards, or book illustrations, or in making technical drawings for industry.

Places of Employment

About 60,000 persons, two-fifths of them women, worked as commercial artists in 1972. Although some commercial artists can be found in nearly every city, the majority work in large cities, such as New York and Chicago, where the largest users of commercial art are located.

Most commercial artists work as staff artists for advertising agencies, commercial art studios, advertising departments of large companies, printing and publishing firms, textile companies, television and motion picture studios, department stores, and a variety of other business organizations. Many are self-employed or freelance artists. Some salaried commercial artists also do freelance work in their spare time. About 2,500 commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools.

Training, Other Qualifications, and Advancement

Artistic ability and good taste are the most important qualifications for success in commercial art. However, these qualities must be developed by specialized training in the techniques of commercial and applied art. Education in the fine arts—painting, sculpture, or architecture—and in academic studies generally provides a good foundation for obtaining employment in commercial art, and may be essential for promotion.

The most widely accepted training for commercial art is the instruction given in art schools or institutes that specialize in commercial and applied art. To enter art school, an applicant must usually have a high school education. Some schools admit only applicants who submit acceptable work samples. The course of study, which may include some academic work, generally takes 2 or 3 years, and a certificate is awarded on graduation. A growing number of art schools, particularly those in or connected with universities, require 4 years or more of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.). In these schools, commercial art instruction is supplemented by liberal art courses, such as English and history. Limited training in commercial art also may be obtained through public vocational high schools and practical experience on the job. However, supplemental training usually is needed for advancement.

The first year in art school may be devoted primarily to the study of fundamentals—perspective, design, color harmony, composition—and to the use of pencil, crayon, pen and ink, and other art media. Subsequent study, generally more specialized, includes drawing from life, advertising design, graphic design, lettering, typography, illustrations, and other courses in the student's particular field of interest. Artistic judgment, imagination, and ability to visualize ideas on paper are basic requirements for a successful career in commercial art.

The various specialities, however, differ in some of the specific abilities required. For example, letterers and retouchers must do precise and detailed work that requires excellent coordination, whereas illustrators and designers need imagination, a distinctive art style, and, in most cases, the ability to draw well. Some experience with photography, typography, and printing production is useful in art direction or design. Freelance commercial artists must sell both ideas and finished work to clients. A knowledge of type specifications and printing production methods is very helpful. A business sense and responsibility in meeting deadlines are assets, also. Art directors need a strong educational background in art and business practices and the liberal arts. Advertising art directors require a special kind of creativity—the ability to conceive ideas that will stimulate the sale of the client's products or services.

Beginning commercial artists usually need some on-the-job training to qualify for other than strictly routine work. Advancement is based largely on the individual's artistic talent, creative ability, and education. After considerable experience, many salaried commercial artists leave to do freelance work. Most illustrators are freelancers; many of them have an agent.

Commercial artists usually assemble their best artwork into a "portfolio," to display their work. A good portfolio is essential in obtaining initial employment and freelance assignments as well as for job changes.

Usually, commercial artists are able to see the results of their work.

Employment Outlook

Talented and well-trained com-

mercial artists are expected to have favorable opportunities for employment and advancement in most kinds of work through the mid-1980's. However, young people with only average ability and little specialized training probably will encounter competition for beginning jobs and have limited opportunity for advancement.

Employment of commercial artists is expected to increase moderately through the 1980's, however. One reason is an anticipated increase in business expenditures for visual advertising such as television graphics, packaging design, and poster and window displays. The expanding field of industrial design also is expected to require more qualified artists to do three-dimensional work with engineering concepts. (See statement in Industrial Designers.) In addition, several thousand jobs for commercial artists are expected to be open each year through the mid-1980's as a result of employment growth and to replace workers who will die, retire, or leave the field for other reasons.

The demand for commercial artists is expected to vary by specialization. For example, demand for pasteup and mechanical artists is expected to increase slightly; jobs for designers, art directors, and layout men will be fewer, much sought after, and open only to experienced, highly talented, and creative artists.

Earnings and Working Conditions

In 1972, beginning commercial artists having no training beyond vocational high school typically earned from $80 to $85 a week; graduates of 2-year professional schools, about $90 a week; and graduates of 4-year post-high school programs, $90 to $100 a week, according to the limited data available. Talented artists who had strong educational backgrounds and good portfolios, however, started at higher salaries. After a few years of experience, qualified artists may expect to earn $125 to $200 a week or more. Art directors, designers, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, from $300 to $400 a week or more.

Earnings of freelance artists vary widely, since they are affected by factors such as skill level, variety, and popularity of work. In general, in 1972, freelancers received from $25 for a single black-and-white fashion sketch to $750 for a figure in full color with a background; from $1,000 to $2,000 for a color cover for a national magazine; or from $75 to $300 for a book jacket or record album. Freelance artists may be paid by the hour or by the assignment. Experienced pasteup and mechanical artists may earn between $4 and $8 an hour.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes they must work additional hours and under a considerable amount of pressure in order to meet deadlines. Freelance artists usually have irregular working hours.

Sources of Additional Information

Information on employment opportunities in commercial art is available from:

National Art Education Association, National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

DISPLAYMEN (RETAIL TRADE)

(D.O.T. 298.081)

Nature of the Work

It happens every shopping day: A woman browsing through a clothing store notices a mannequin wearing an attractive pants suit and without having planned to, takes a similar outfit home. A fishing enthusiast sees a display of angling equipment in a sporting goods store window, goes in, and buys a new reel. A young mother is attracted by a colorful pyramid of lunch boxes in a drugstore window and decides to buy one for her son.

Incidents like these show how displays in stores and store windows can attract customers and encourage them to buy. Knowing the effectiveness of this form of advertising, some stores allot a large share of their publicity budget to displays.

Displaymen specialize in designing and installing such exhibits. Their aim is to develop attractive, eye-catching ways of showing store merchandise to best advantage. To create a setting that enhances the merchandise, displaymen need imagination as well as knowledge of color harmony, composition, and other fundamentals of art. They may, for example, choose a theme—a beach setting to advertise swimming suits and surfing equipment—and design an eye-catching display around this theme. After the design has been approved by the store's management, displaymen obtain the props and other accessories needed for the display. This is where their craft skills come into play.

Displaymen construct many of the props themselves. They use saws, pliers, stapling guns, hammers, and other tools to build props and paint them with brushes or spray guns. They may be assisted in these tasks

Displayman arranges items in aisle display.

by a helper or store maintenance men. Displaymen may also use props out of storage, designed for previous displays. They may order additional props from firms which specialize in them. The displaymen install the props, background settings, and lighting equipment; dress mannequins; and add other finishing touches. Periodically, they dismantle old displays and replace them with new ones.

In large stores that employ several displaymen, each may specialize in a particular activity such as carpentry, painting, making signs, installing displays, or dressing mannequins. Overall planning and admistration in large stores is usually the responsibility of a display director who supervises and coordinates the activities of the department. The director confers with other executives, such as advertising and sales managers, to select merchandise to be promoted and to design displays.

Places of Employment

About 33,000 displaymen worked in retail stores in 1972; nearly half were women. Most worked for department, clothing, and home-furnishing stores, others in variety, drug, and shoe stores and in book and gift shops. Several thousand additional freelance or self-employed displaymen serviced small stores that needed professional window dressing but that could not afford full-time displaymen. Freelancers are among the most highly-skilled workers in this field.

While major department stores may have as many as 30 or 40 displaymen, most stores have only one or two. Freelance displaymen and those on small staffs perform a variety of tasks that require both artistic talents and craft skills.

Geographically, employment is distributed much like the Nation's population, with most jobs in larger towns and cities.

Training, Other Qualifications, and Advancement

Most displaymen learn their trade through informal on-the-job training. Beginners are hired as helpers to dismantle displays, carry props, and do other routine tasks. Gradually, they are given the opportunity to do more difficult work such as building props and, if they show artistic talent, planning simple designs. A beginner usually can become a skilled displaymen in 2 to 3 years. Training time varies, however, depending on the beginner's ability and the variety and complexity of displays that the employer requires.

When hiring inexperienced workers, most employers will consider only applicants who have finished high school. Courses that provide helpful training for display work include art, woodworking, mechanical drawing, and merchandising. Some employers prefer applicants who have completed college courses in art, interior decorating, fashion design, advertising, and related subjects. College training improves the worker's opportunities for advancement to managerial jobs.

Creative ability, manual dexterity, and mechanical aptitude are among the most important personal qualifications needed in this field. Good physical condition and agility are needed to carry equipment, climb ladders, and work in close quarters without upsetting props.

Advancement may take several forms. A displayman with supervisory ability might become display director in a large store. A display director might in turn progress to

sales promotion director and, perhaps, eventually, to general manager.

Freelance work is another avenue of advancement. Some moonlight at this work until they have enough clients for full-time work. Relatively little money is needed to start a freelance business, but since this is a highly competitive field, self-employment is likely to involve a struggle.

The displayman's skills could lead to work in other art-related occupations like interior decoration or photography. These occupations, however, require additional training.

Employment Outlook

A moderate rise in the employment of displaymen is expected through the mid-1980's. In addition to employment growth, many openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

The chief spur to employment gains is expected to be the construction of additional stores as population grows. Also, many stores are placing greater emphasis on window and interior displays as a means to stimulate sales. Employment growth, however, may be slowed by the increasing use of prefabricated props and permanent background settings.

Earnings and Working Conditions

According to many large employers, weekly salaries for beginners ranged from $75 to $100 in 1972. Beginners who have completed college courses in art, interior decorating, or related subjects generally receive higher starting salaries. Experienced displaymen's salaries range from $120 to $175 a week, the variation depending largely on experience and ability. Most display directors earn more than $10,000 a year, and some more than $15,000.

The earnings of freelance displaymen depend on their talent and prestige, on the number and kinds of stores they service, and on the amounts of time they devote to the work. Many freelancers earn more than $15,000 a year, and some earn more than $30,000.

Many displaymen enjoy the satisfaction of doing creative work. Developing an original design and transforming it into reality can be a highly rewarding experience.

Large stores usually provide benefits that include paid vacations, holidays, and sick leave. Most stores also allow employees to buy merchandise at a discount. Many provide employee retirement plans.

Displaymen usually work 35 to 40 hours a week. During busy seasons, such as Christmas and Easter, they may be asked to work nights and weekends to prepare special displays. Those who work overtime receive either additional pay or else an equal amount of time off during slow periods.

Physical requirements must be kept in mind when considering this field. Constructing and installing props frequently requires prolonged standing, bending, stooping, and working in awkward positions. Displaymen risk injury from falls off ladders, from contact with sharp or rough materials, and from the use of power tools, but serious injuries are uncommon.

Sources of Additional Information

Details on career opportunities can be obtained from local retailers, such as department stores, and from local offices of the State employment service.

FLORAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

Floral designers assemble loose flowers into arrangements for gifts and decorations. These may range from cheerful designs for hospital patients to more traditional bridal bouquets. Because flowers are generally used to express a customer's thoughts or sentiments, designers must create arrangements appropriate for the purpose.

Designers usually work from written instructions which indicate the customer's preference for color and type of flower, as well as the cost, date, time and place the arrangements are to be delivered. For most orders, designers select a standard or stock design.

Even with standard orders, designers have a chance to use their creative talents. For example, they may select carnations in place of chrysanthemums or white tulips for calla lilies. To make these choices, designers must understand the physical qualities of the flowers concerned. For instance, some flowers wither more quickly than others, and some flowers can be sprayed with dies that will shrivel others.

A standard order for a funeral design may read "red and white funeral spray, $15.00." Floral designers know the customer expects the flowers to be fixed to a stand, rather than placed in a vase. They choose appropriate flowers, for instance, white gladioli and red carnations. These flowers are right for the occasion and within the cost limits of the order. For the foundation, designers use a block of styrofoam slightly smaller than a telephone book attached near the top of a three-legged wire stand. The wide surface of the styrofoam, facing the

viewer, is to be the center of the arrangement.

Designers now choose among the gladioli and carnations in the storage refrigerator and take them to their work tables. They cut the gladioli stems to size and wire a small wooden stake to each, slightly below the bottom of the petals. They then straighten the carnation stems with wire inserted into the base of the blossom and twisted around the stem. These preparations ensure that the gladioli stems will penetrate the styrofoam and that the carnation stems will remain rigid.

To make a frame and background for the flowers, they insert green leafy branches, such as fern, into the styrofoam. Designers then add the gladioli, making sure that they are evenly spaced and that the tips of the flowers approximate a circle. The carnations are placed between the gladioli to form a smaller circle and lend color contrast. Designers make a bow and place it in the center of the arrangement. They add more foliage as needed to fill in spaces and to give uniform texture. The order is completed in about 15 minutes.

Special orders take more of the designer's time and creative effort. In these cases, designers normally discuss the order with the customer. If the customer, as a house guest, wants an arrangement as a gift for his hostess, designers need to know whether to make, for example, a dining table centerpiece or living room decoration. They ask, also, if one specific flower or color scheme is preferred. Finally, they need to know how much the customer wishes to spend. With this information in mind, designers are ready to go to work. Customers usually prefer designers to use their own judgement to assemble the arrangement. For this reason, special orders give designers a better chance to display their style and originality than do standard orders. Because they have wide latitude, the design may be one they have used previously, a new twist to a standard design, or completely original.

Some designers spend most of their time filling special orders. Because most retail florist shops sell fewer arrangements than can be prepared in a day, floral designers usually have other duties. They assist customers in selecting flowers and plants and other gifts and floral accessories available in the store. Occasionally, they may order flowers and supplies from dealers, trim and water flowers for storage, and help with the cleaning. In larger florist shops, however, designers devote most of their time to making arrangements.

Places of Employment

About 30,000 floral designers were employed in 1972. About three-fifths were women. Nearly all designers worked in the retail flower shops common to large cities, suburban shopping centers, and small towns. The remaining few worked for large grocery and variety stores. Most shops employed only one or two floral designers. Geographically, employment was distributed much the same as population.

Training, Other Qualifications, and Advancement

Most floral designers are trained on the job. Beginners usually are hired as helpers. They prepare flowers for storage, deliver orders, and do general cleanup work. Shop managers look for bright, eager helpers, who have pleasant personalities and a neat appearance necessary to deal effectively with customers. After a few weeks, helpers learn enough about flowers, potted plants, and gift items to assist customers in making selections.

Young people who want to become floral designers usually take a job with the understanding that they will be trained in floral design by the manager or an experienced floral designer employed in the shop. Initially they copy simple arrangements, that use one type of flower. If they demonstrate manual dexterity and a sense of balance for color and shape instruction in more complex arrangements is given. As experience is gained, original designs required for special orders can be attempted. Two years of on-the-job training usually are required in order to become a fully qualified floral designer.

Good color vision, manual dexterity, and an artistic sense of balance in line and color, are primary qualifications for this occupation. A high school diploma generally is not required, but applicants must be able to write legibly and do simple arith-

metic in order to write up bills for customers. High school courses in business arithmetic, salesmanship, and other business subjects are helpful. While still in school, a student may work as a part-time helper in a flower shop. Such jobs frequently become available before holiday seasons such as Christmas and Easter when orders for floral arrangements increase sharply.

An increasing number of floral designers take courses in floral arrangement in public and private schools. Some courses are offered at the junior college level. However, whether they last from 6 weeks to 2 years, courses are not a substitute for on-the-job training and experience. The longer courses provide training in flower marketing and shop management for floral designers who plan to operate their own shops. Only applicants with high school diplomas are accepted.

Floral designers have limited advancement possibilities. Those with supervisory ability may advance to manager in large flower shops. Managers who have the necessary capital may open their own shops.

Employment Outlook

Employment of floral designers is expected to increase very rapidly through the mid-1980's. Population growth and rising levels of personal income should result in a substantial increase in orders for flowers and thus more designers will be needed. In addition to job openings created by employment growth, many openings will arise each year as workers retire, die, or change occupations and as women leave their jobs to marry or tend to family responsibilities.

Earnings and Working Conditions

Limited information indicates that fully qualified designers earned between $2.50 and $5.00 an hour in 1972. Beginning rates for trainees ranged from $1.60 to $2 an hour. Besides earning money, floral designers achieve the satisfaction of doing creative work and seeing their ideas transformed into reality.

In small shops, floral designers usually work 8 hours a day, Monday through Saturday. In many large shops, designers who work Saturday get a day off during the week.

Most designers receive holiday and vacation pay. Generally, they receive 2 week's paid vacation after 3 years on the job, and 3 weeks after 10 years. Because most shops are small other fringe benefits are limited. Some employers pay part of the cost of group life and health insurance but few contribute to retirement plans other than social security. Floral designers in a few cities are members of the Retail Clerks International Association.

Floral designers must have the stamina to work in a standing position for long periods. Work areas are kept cool and humid to preserve the flowers. Designers are exposed to sudden temperature changes when entering or leaving storage refrigerators. Aside from the possibility of small cuts from knives or scratches from flower thorns there are few hazards in this occupation.

Sources of Additional Information

Additional information about careers in floral design and addresses of schools offering courses in this field can be obtained from:

Society of American Florists and Ornamental Horticulturists, 901 N. Washington St., Alexandria, Va. 22314.

INDUSTRIAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

When someone buys a product, whether it's a home appliance, a new car, or a ball point pen, he wants it to be attractive as well as useful. Industrial designers combine artistic talent with knowledge of marketing, materials, machines, and methods of production to improve the appearance and functional design of products.

Since the consuming public has wide choices of styles in products such as radios, television sets, and furniture, a primary objective of the industrial designer is to design a product that competes favorably with similar goods on the market. A successfully designed consumer product must have an attractive appearance, be easy to use, and coordinate well with related products while having its cost of manufacture as low as possible. Besides consumer products, industrial designers work with industrial, medical, and scientific equipment. Frequently, they redesign these products to make them easier to use.

As the first step in their work, industrial designers study the product and competing products to determine the different ways in which the product may be used. Then they sketch a variety of possible designs and consult with others, such as engineers, production supervisors, and sales and market research personnel, for their opinions on the practicability and sales appeal of each idea.

After company officials select the most suitable design, a model is made. In some firms this model is made by the industrial designer, in others by professional modelers. The first model of a new design is often made of clay so the designer can easi-

ly change it. The final or working model is usually made of the material to be used in the finished product. If the model is approved in this form, it is put into production.

Some industrial designers seek to create favorable public images for companies and for government-provided services such as transportation, by developing trademarks or symbols that appear on the firm's product, advertising, brochures, and stationery. Some design containers and packages which must both protect and promote their contents. Others prepare small exhibits for display purposes or design the entire layout for industrial fairs. Some design the interior layout of special purpose commercial buildings such as restaurants and supermarkets.

Industrial designers employed by a manufacturing company usually work only on the products made by their employer, but this too can vary from filling the day-to-day design needs of the company to long-range planning for new products. Designers who work as consultants to more than one industrial firm may plan and design a great variety of products.

Places of Employment

About 10,000 persons—mostly men—worked as industrial designers in 1972. Most worked for large manufacturing companies or design consulting firms. Others did freelance work, or were on the staffs of architectural and interior design firms.

Industrial designers in consulting firms work mainly in large cities. For example, New York, Chicago, Los Angeles, and San Francisco have the largest number of design consulting organizations. Those in industrial firms work in the manufacturing plants of their companies, which often are located in small—and medium—size cities.

Training, Other Qualifications, and Advancement

Completing a course of study in industrial design in an art school, the design or art department of a university, or a technical college is the usual requirement for entering this field of work. Persons from other fields, however, notably engineering, architecture, and fine arts, may qualify as industrial designers if they have appropriate experience and artistic talent. Most of the large manufacturing firms will only hire industrial designers who have a bachelor's degree in the field.

In 1972, over 60 colleges and art schools offered programs or courses in industrial design. The Industrial Designers Society of America recognizes 25 of these programs as effective in preparing average students for employment as industrial designers.

Formal education in industrial design at the college or university level usually takes 4 years to complete; a few schools require 5 years of study. These schools award a bachelor's degree in industrial design or fine arts; some also award a master's degree.

Entrance to a course of study in industrial design is limited, with rare exceptions, to qualified high school graduates; in addition, some schools require students to present sketches and other examples of their artistic ability.

Industrial design programs differ considerably among schools. Some stress the engineering and technical aspects of the field, while others give students a strong background in art. In a typical industrial design program much time is spent in the major design lab, where the student can practice designing objects in three dimensions. In the studio course, students learn to make working drawings and models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students gain experience in making models of their designs while learning to use metalworking and woodworking machinery. Students also take basic and abstract art and sculpture courses. Some schools require courses in basic engineering and composition of materials. Courses in business administration and merchandising can be helpful in getting a job.

Industrial designers must have creative talent, drawing skills, and the ability to see familiar objects in new ways. They must also understand the needs and tastes of the public, rather than design only to suit their own artistic sensitivity. Designers should not be easily discouraged when their ideas are rejected—often designs must be resubmitted many times before one is accepted. Since industrial designers are required to cooperate with engineers and other staff members, the ability to work and communicate well with others is important. Those who plan to practice industrial designing on a consulting basis should understand business practices and have sales ability.

Applicants for jobs should assemble a "portfolio" that demonstrates their creative talent and ability to communicate ideas through drawings and sketches.

New graduates of industrial design courses frequently start as assistants to experienced designers. They are usually given relatively simple design assignments. As they gain experience, designers may be assigned to supervisory positions with major responsibility for the design of a product or a group of products. Those who have an established reputation in the field, as well as the necessary funds, may start their own consulting firms.

Employment Outlook

New entrants trained specifically

in industrial designing may face competition for beginning jobs from persons with engineering, architectural, and related backgrounds who have artistic and creative talent. Employers, however, will actively seek applicants with a design degree and outstanding talent.

Employment in this relatively small occupation is expected to expand slowly but steadly through the mid-1980's. Growing population and rising incomes will create markets for newly designed products. This creates jobs for industrial designers because as in the past, manufacturers will strive to increase their sales through creating new products, improving existing ones, and improving the packaging and appearance of their products.

Frequent redesign of household products, automobiles, and industrial equipment has always created a need for designers. However, recently there has been some indication of a trend away from annual style changes which may somewhat lessen demand for industrial designers.

Small companies probably will make increasing use of services offered by industrial design consulting firms to compete more effectively with larger firms. However, some of these services, such as trademark and package design, could be offered by advertising agencies as well as industrial design consultants.

Some employment opportunities also will arise each year from the need to replace designers who die, retire, or leave the field.

Earnings and Working Conditions

Starting salaries for inexperienced industrial designers with a bachelor's degree generally ranged from $7,000 to $10,000 a year in 1972, according to limited data. After several years experience, it is possible to earn $10,000 to $15,000 a year. Salaries of those with many years of experience averaged about $20,000 a year, but varied greatly depending on factors such as individual talent and the size and type of firm in which they work.

Earnings of industrial designers who own their consulting firms, alone or as members of a partnership, may fluctuate markedly from year to year. In recent years, earnings of most consultants were between $20,000 and $30,000 and heads of large well-known firms earned considerably more.

Sources of Additional Information

A brochure about careers and a list of schools offering courses and degrees in industrial design are available, for 50 cents from:

Industrial Designers Society of America, 1750 Old Meadow Rd., McLean, Va. 22101.

INTERIOR DESIGNERS

(D.O.T. 142.051)

Nature of the Work

The creative work of interior designers, sometimes called *interior decorators*, helps make our living, working, and playing areas more attractive and useful. Interior designers plan and supervise the design and arrangement of building interiors and furnishings. They help clients select furniture, draperies, other fabrics, floor coverings, and accessories. They also estimate what any work or furnishings will cost. Interior designers may do "boardwork", particularly on large assignments. This boardwork includes work on floor plans and elevations and the preparation of sketches or other perspective drawings so clients can visualize their plans. After the client approves both the plans and the cost, the designer may make arrangements for buying the furnishings; for supervising the work of painters, floor finishers, cabinet makers, carpet layers, and other craftsmen; and for installing and arranging the furnishings.

Many large department and furniture stores have separate design departments to advise their customers on decorating and design plans. The main purpose of the designers in these departments is to help sell the store's merchandise, although materials from outside sources may be used occasionally when they are essential to the plans developed for the customer. Department store designers frequently advise the store's buyers and executives about style and color trends in interior furnishings.

Interior designers may work on private homes or commercial buildings. Those who specialize in commercial structures often work for clients on large design projects such as the interiors of entire office buildings, hospitals, and libraries. Generally their plans include the complete layout of the rooms within the space allowed by the exterior walls and other framework. Sometimes they redesign or renovate the interiors of old buildings. When their plans have been completed, an architect checks them against building plans to assure compliance with building requirements and to solve structural problems. Some interior designers also design the furniture and accessories to be used in interiors, and then arrange for their manufacture. A few interior designers have unusual jobs such as designing interiors of ships and aircraft, while others design stage sets used for motion pictures or television.

Places of Employment

About 18,000 persons—half of them men—worked as interior designers in 1972. Additional persons worked in this field on a part-time basis. Most workers in this occupation are employed in large cities.

Some interior designers own their own establishment, either alone or as members of a firm with other designers. Many sell some or all of the merchandise with which they work. Designers may work independently or as assistants and sometimes have large staffs, including salespersons.

Other interior designers work in large department or furniture stores, and a few have permanent jobs with hotel and restaurant chains. Some work for architects, furniture suppliers, antique dealers, furniture and textile manufacturers, or other manufacturers in the interior furnishing field.

Interior designers may work for magazines that feature articles on home furnishings. Some large industrial corporations employ interior designers on a permanent basis.

Training, Other Qualifications, and Advancement

Formal training in interior design is becoming increasingly important for entrance into this field of work. Most department stores, well established design firms, and other major employers will accept only professionally trained people for beginning jobs. In 1972, 15 schools offered 2-year programs leading to an Associate Degree in Interior Design, seven schools had 3-year programs, 66 colleges and universities offered a bachelor's degree in the field, and 23 had programs leading to a master's degree or the Ph.D. The course of study usually includes the principles of design, history of art, freehand and mechanical drawing, painting, study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as woods, plastics, metals, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in salesmanship, business procedures, and other business subjects are valuable.

Membership in either the American Institute of Interior Designers (AID) or the National Society of Interior Designers (NSID), both professional societies, is a recognized mark of achievement in this profession. Membership usually requires the completion of 3 or 4 years of post-high school education; the major emphasis should be on training in design. Another requirement is several years of practical experience in the field, including supervisory work.

Young people starting in interior design usually serve a training period, either with design firms, in department stores, or in furniture stores. They may act as receptionists, as shoppers with the task of matching materials or finding accessories, or as stockroom assistants, assistant decorators, or junior designers. In most instances, from 1 to 5 years of on-the-job training is required before a trainee is considered eligible for advancement to the job of designer. Beginners who do not get trainee jobs often work selling fabric, lamp, or other interior furnishings to gain experience in dealing with customers and to become familiar with the merchandise. This experience often makes getting trainee jobs in

design easier; it also may lead to a career in merchandising.

After considerable experience, designers with ability may advance to design department head, interior furnishings coordinator, or to other supervisory positions in department stores or in large design firms. If they have the necessary funds, they may open their own establishments. Exceptionally talented people can advance rapidly.

Artistic talent—color sense, good taste, imagination—, good business judgement, and the ability to deal with people are important assets for success in this field. Interior designers should be able to work with detail. An advantage to interior design as a career is the satisfaction of seeing the results of one's work.

Employment Outlook

Persons seeking beginning jobs in interior designing probably will face competition through the mid-1980's. Interior designing is a competitive field that requires talent, training, and business ability, and many applicants vie for the better jobs. Talented art school or college graduates who major in interior design will find good opportunity for employment. Those with less talent or without formal training will find it increasingly difficult to enter this field.

Employment of interior designers is expected to increase moderately through the mid-80's. Population growth, more families with high incomes, larger expenditures for home and office furnishings, the increasing availability of well-designed furnishings at moderate prices, a growing recognition among middle-income families of the value of design services, and increasing use of these services by commercial establishments should contribute to a greater demand for these workers. In addition to new jobs, some openings will be created by the need to replace designers who die, retire, or leave the field.

Department and furniture stores are expected to employ an increasing number of designers. These stores also are expected to share in the growing volume of design work for commercial establishments and public buildings, formerly handled almost entirely by independent designers. This development will result in increased opportunities for salaried jobs. However, some stores prefer giving design courses to their salesworkers instead of hiring trained persons. Interior design firms also are expected to continue to expand. Employment of interior designers, however, is sensitive to change in general economic conditions, because people often forego design services when the economy slows down.

Earnings and Working Conditions

Earnings of interior designers vary greatly depending on the parts of the country and the types of firms in which they work. Beginning salaries ranged generally from $75 to $100 a week in 1972 for an art school or college graduate having formal training in interior design; some graduates of 3− or 4−year programs received salaries between $125 and $150 a week, according to the limited data available.

Some interior designers are paid straight salaries. Some receive salaries and commissions which usually range from 5 to 10 percent of the value of their sales. Others receive commissions only, which may be as much as one-third of the value of their sales.

Many persons who have only average skill in this field earn only moderate incomes—from $5,000 to $10,000 a year, even after many years of experience. Talented designers who are well-known in their localities may earn up to $15,000 or more. Designers who have nationally recognized ability may earn over $25,000 yearly.

The earnings of self-employed designers vary widely depending on the volume of business, their professional prestige, the economic levels of their clients, their own business competence, and the percentage of wholesale prices they receive from the sale of furnishings.

Hours of work for designers are sometimes long and irregular. Designers usually adjust their workday to suit the needs of their clients, meeting with them during the evenings or on weekends, when necessary.

Sources of Additional Information

For information about careers in interior design and a list of schools offering programs in this field, contact:

National Society of Interior Designers, Inc., 312 East 62nd St., New York, N.Y. 10021.

American Institute of Interior Designers, 730 Fifth Ave., New York, N.Y. 10019.

Foundation for Interior Design Education Research, 1750 Old Meadow Rd., McLean, Va. 22101.

LANDSCAPE ARCHITECTS

(D.O.T. .019.081)

Nature of the Work

Everyone enjoys attractively designed outdoor areas that have an abundance of trees and shade along with grassy open spaces, ponds, and

walkways free from dangerous traffic. This attractiveness reflects the skills of landscape architects who see that commercial and recreational areas have useful and natural-looking landscapes.

Landscape architects assist many types of organizations in planning and designing a project, from a real estate firm starting a new suburban development to a city building an airport or park. They help plan and design the arrangement of trees, shrubbery, walkways, open spaces, and other features of a project's site, and also may supervise the grading, construction, and planting required to carry out the plan.

In planning a site, landscape architects first study the nature and purpose of the project, the funds available for the job, and the various types of proposed buildings. Next they study the site itself, observing and mapping features such as the slope of the land and the position of existing buildings and trees. They also consider the parts of the site that will be sunny or shady at different times of the day, the structure of the soil, existing utilities, and many other factors affecting a landscape's design. Then, after consultation with the architect or engineer working on the project, they draw up plans for the development of the site. If the plan is approved, landscape architects prepare working drawings showing all existing and proposed features such as buildings, roads, walkways, terraces, grading, and drainage structures in planted areas. Landscape architects outline in detail the methods of constructing features and draw up lists of building materials. They then may invite landscape contractors to bid for the work.

Landscape architects help design and supervise a wide variety of projects. Some, however, specialize in certain types of projects such as parks and playgrounds, campuses, hotels and resorts, shopping centers, roads, or public housing. Still others may specialize in certain services such as regional planning and resource management, site selection, feasibility and cost studies, or site construction.

Places of Employment

About 12,000 persons worked as landscape architects in 1972; 10 to 15 percent were women. Most landscape architects are self-employed or work for private architectural, landscape architectural, or engineering firms. Government agencies concerned with public housing, city planning, urban renewal, highways, parks, and recreation, employed about 40 percent of all landscape architects. The Federal Government employed about 600 landscape architects, mainly in the Departments of Agriculture, Defense, Interior, and Housing and Urban Development. Some landscape architects were employed by landscape contractors, and a few taught in colleges and universities.

Training, Other Qualifications, and Advancement

A bachelor's degree in landscape architecture is usually the minimum educational requirement for entering the profession. At least 64 colleges and universities offer this training; 28 of these have accreditation from the American Society of Landscape Architects. Another 36 schools offer courses in landscape architecture, but not complete degree programs. The curriculum for a bachelor's degree requires 4 to 5 years of study depending on the institution. Twelve universities offer a master's degree in landscape architecture.

Entrance requirements for landscape architecture programs are usually the same as those for admission to a liberal arts college. Some colleges require completion of a high school course in mechanical or geometrical drawing, and most schools advise high school students to take courses in art, botany, and more mathematics than the minimum required for college entrance.

College courses include such technical subjects as surveying, landscape and architectural design, landscape construction, plant materials and design, sketching, recreational and city planning, contracts, specifications, cost estimates, and business practices. Other courses include horticulture and botany as well as English, science, social sciences, and mathematics. Most college programs also include field trips to view and study examples of landscape architecture.

Twenty-six States require a license for independent practice of landscape architecture—Alabama, Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Nebraska, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Washington, and West Virginia. Admission to the licensing examination usually requires a degree from an accredited school of landscape architecture plus 2 to 4 years of experience. For admission to the licensing examination, lengthy apprenticeship training (6-8 years) under an experienced landscape architect may be substituted for college training, however, this method is slow and not always acceptable to public agencies.

Persons planning careers in landscape architecture should be interested in art and nature since the work requires a talent for design and an understanding of plant life. Self-employed landscape architects also

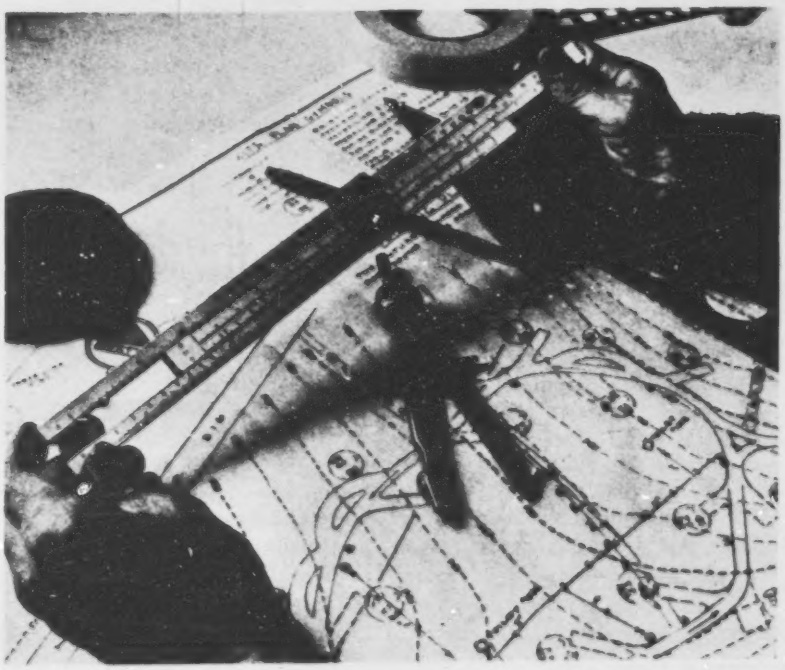
must understand business practices and be able to deal with others since it is often necessary to bid for contracts. Working for landscape architects or landscape contractors during summer vacations helps a person to understand the practical problems of the profession, and the experience may be helpful for gaining employment after graduation.

New graduates usually begin as junior draftsmen, tracing drawings and doing other simple drafting work. After gaining experience, they may help prepare specifications and details of construction procedures and handle other aspects of landscape architecture. After 2 or 3 years they usually become qualified to carry a design through all stages of its development. Those who work for private firms and demonstrate exceptional ability in all phases of the work may become associates of the firm; landscape architects who progress this far, however, often open their own office.

Employment Outlook

Employment opportunities for graduates with professional training in landscape architecture are expected to be favorable through the mid-1980's. Very rapid growth is expected for the profession and additional workers will be needed to replace those who die or retire.

A major factor underlying the increased demand for landscape architects is the growing interest in city and regional environmental planning. Metropolitan areas will require landscape architects to help plan the development of land for the efficient and safe use of their growing populations. Legislation to promote environmental protection could spur demand for landscape architects to participate in planning and designing a growing number of public and private construction projects, particularly for housing, transportation, and outdoor recreation. Rising average incomes and living standards along with increased homeownership will also increase the demand for landscape architects.



Earnings and Working Conditions

In 1972, starting salaries in private firms for new graduates having a bachelor's degree in landscape architecture ranged from about $8,000 to $12,000 annually; holders of a master's degree generally earned starting salaries between $9,500 and $13,500. Earnings of experienced landscape architects in private firms were very high—$16,000 to $21,000 a year in 1972—compared to average earnings of nonsupervisory workers in private industry, except farming.

Landscape architects in independent practice often earn more than salaried employees with considerable experience, but their earnings may fluctuate widely from year to year.

The Federal Government, in early 1973, paid new graduates with a bachelor's degree annual salaries of $7,694 or $9,529 depending on their qualifications. Those with advanced degrees had starting salaries ranging from $11,614 to $16,682 a year.

Salaried employees both in government and in landscape architectural firms usually work regular hours. Self-employed persons often work long hours. Salaried employees in private firms may also work overtime during seasonal rush periods or to meet a deadline.

Sources of Additional Information

Additional information including a list of colleges and universities offering accredited courses of study in landscape architecture may be obtained from:

American Society of Landscape Architecture, Inc., 1750 Old Meadow Rd., McLean, Va. 22101.

For information on a career as a landscape architect in the Forest Service, write to:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

PHOTOGRAPHERS

(D.O.T. 143.062, .282 and .382)

Nature of the Work

Photographers use their cameras and other equipment to portray people and events on film. Skillful portrait photographers, for example, take pictures that are natural looking, attractive, and expressive of an individual's personality. Those who photograph sporting and news events try to show the exciting action as it is occurring.

Although their work varies, all photographers use the same basic equipment and materials. These include a variety of still and motion picture cameras equipped with different types of light filters and lenses. Photographers select film and filters according to the type of picture being taken, the camera, and the lighting. Because the procedures for taking motion pictures differ from those used in still photography, most photographers restrict themselves to one field or the other. When taking pictures indoors or after dark, photographers use flash bulbs or electronic flashes, floodlights, reflectors, or other special lighting equipment. They also use various chemical and mechanical processes to develop, enlarge, and print pictures. In small shops and photographic departments, the photographer often does all this technical work; in large studios photographic technicians do the needed laboratory work. (See statement on Photographic Laboratory Occupations.)

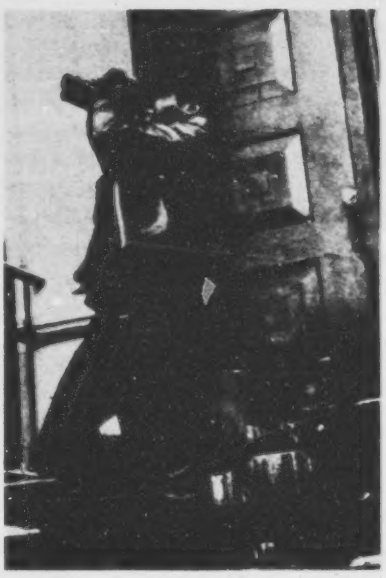
In addition to knowing how to use photographic equipment and materials, photographers must know how to arrange their subjects properly against a setting, and how to use makeup and props.

Many photographers specialize in areas such as portrait, commercial, or industrial photography. Portrait photographers usually work in their own studios, although they also take pictures in people's homes and other places. Commercial photographers generally take pictures to advertise real estate, furniture, food, apparel, and other items. The work of industrial photographers is used in company publications and to advertise company products or services. These photographers also may take motion pictures of workers operating equipment and machinery for management's use in simplifying production or work methods.

Other photographic specialties include press photography (photojournalism that combines a "nose for news" with photographic ability); aerial photography; instrumentation photography; educational photography (preparing slides, filmstrips, and movies for use in the classroom); and science and engineering photography (the development of photographic techniques for use in space research and related fields).

Places of Employment

Approximately 77,000 people—over three-fourths of them men—worked as photographers in 1972. About one-half worked in commercial studios, either in business for themselves or as salaried employees. Large numbers also were employed by industry, government agencies, camera stores, and newspapers and magazines. In addition, some photographers taught in high schools or colleges, sold photographic equipment and supplies, or produced documentary films. Still others worked freelance, taking pictures to sell to advertisers, magazines, and other customers.



Jobs for photographers are found in small towns as well as cities, but most are concentrated in heavily populated States such as California, New York, Pennsylvania, Ohio, and Illinois.

Training, Other Qualifications, and Advancement

Young people may prepare for work as professional photographers through 2 or 3 years of on-the-job training in a commercial studio. Trainees generally start in the darkroom where they learn to develop film and to do photo-printing and enlarging. Later they may set up lights and cameras, or help an experienced photographer take pictures.

Photographic training also is available in many colleges, universities, junior colleges, and art

schools. About 134 colleges and universities offer 4-year curriculums leading to a bachelor's degree in photography and related subjects. These curriculums include liberal arts subjects as well as courses in professional photography. Master's and doctor's degrees in specialized areas, such as color photography, also are granted by some colleges and universities. In addition, a few colleges have 2-year curriculums leading to a certificate or an associate's degree in photography. Art schools offer useful training in design, although they usually do not provide the technical training needed for camera work. (See statement on Commercial Artists.)

The Federal Government sponsors programs to train unemployed and underemployed workers for entry positions as photographers under provisions of the Manpower Development and Training Act and other legislation. Many young people also learn photographic skills while serving in the Armed Forces.

The kind and amount of training people have influence the type of photographic work for which they can qualify. While amateur experience is helpful in getting an entry job, considerable post-high school training and experience usually are needed for industrial, news, or scientific photography. Photographic work in scientific and engineering research generally requires a background in science and engineering, as well as skill in photography.

Prospective photographers should have manual dexterity, good eyesight and color vision and some artistic ability. They also should like to work with detail, and should have a pleasant and courteous manner. Some forms of photography require additional qualities; a photographer in commercial or freelance work must be imaginative and original in his thinking. One in press photography should be able to judge what would make a good news picture and act quickly on his judgment.

Newly hired photographers take relatively simple still and motion pictures. After gaining experience they may advance to higher-paying jobs that require artistic ability. Many press photographers, for example, advance from filming real estate to covering national news events. Others join staffs of news magazines. Photographers with exceptional ability may be promoted to executive positions, such as director of scientific and engineering photography or graphic arts.

Employment Outlook

Hundreds of talented and well-trained people will be needed each year through the mid-1980's to fill new positions created by an expected growth in the photographic field, and to replace those who retire, die, or stop working for other reasons. Those with limited ability and training, however, are likely to face competition and find few opportunities for advancement.

Job opportunities in technical work, such as industrial photography, are expected to increase moderately as more photographers are needed in research and business, and as industry uses more visual aids. Those seeking work as scientific photographers or photojournalists also will find good opportunities as these specialties grow in importance. Competition for employment as portrait and commercial photographers, however, is expected to be keen. These fields are easily entered since a photographer can go into business for himself with a modest financial investment, or work part time while holding another job.

Earnings and Working Conditions

Beginning photographers generally earned from $80 to $125 a week in 1972, according to the limited information available.

Inexperienced photographers employed by most daily newspapers that have contracts with the American Newspaper Guild started at salaries ranging from $125 to $175 a week. For photographers employed by a few small daily newspapers, the Guild starting salaries were less than $100 a week; on a few large dailies, Guild minimums for beginning photographers were $200 a week or more.

Minimum rates for newspaper photographers with some experience (usually 4 to 6 years) averaged about $240 a week in 1972. Contract minimums for experienced photographers on a few small dailies were less than $180 a week; on a few large dailies, they ranged from $290 to $355 a week. Photographers who had a science or engineering background usually received beginning salaries between $9,000 and $10,000 a year.

Depending on their level of experience, newly hired photographers in the Federal Government earned from $6,880 to $9,520 a year in early 1973. Most experienced photographers in the Federal Government earned between $11,600 and $16,680 a year; a few earned over $17,000 annually.

Many experienced photographers with established reputations earn salaries that are above the average for nonsupervisory workers in private industry, except farming. Although self-employed photographers generally earn more than salaried workers, their earnings are affected greatly by business conditions and other factors such as the type and size of community and clientele.

Photographers who have salaried jobs usually work the standard 5-day, 40-hour week and receive benefits such as paid holidays, vacations,

and sick leave. Those in business for themselves frequently work longer hours. Freelance, press, and commercial photographers may travel frequently.

Sources of Additional Information

Career information on photography is available from:

Professional Photographers of America, Inc., 1090 Executive Way, Oak Leaf Commons, Des Plaines, Ill. 60018.

URBAN PLANNERS

(D.O.T. 199.168)

Nature of the Work

Urban planners, sometimes called regional or community planners, develop programs to provide for future growth and revitalization of urban communities. They try to remedy problems such as deteriorating business and residential areas, inadequate park and recreation facilities, and air pollution.

Planners examine community facilities such as health clinics and schools to be sure these facilities can meet the demands placed upon them. They also keep abreast of the legal issues involved in community development and redevelopment and any changes in housing and building codes. Because suburban growth has increased the need for better ways of traveling to the urban center, the planner's job often includes designing new transportation and parking facilities.

Urban planners project future conditions that may develop as a result of population growth or social and economic change, and estimate, for example, the community's long-range needs for housing, transportation, and business and industrial sites. Working within a framework set by the community government, they analyze and propose alternative ways to achieve more efficient and attractive urban areas.

Before drawing plans for long-range community development, urban planners prepare detailed studies that show the current use of land for residential, business, and community purposes. These reports present information such as the arrangement of streets, highways, and water and sewer lines, and the location of schools, libraries, and playgrounds. They also provide information on the type of industry in the community, characteristics of the population, and employment and economic trends. With this information, urban planners propose ways of using undeveloped land and design the layout of recommended buildings and other facilities such as subways. They also prepare materials that show how their programs can be carried out and the approximate costs.

Urban planners often confer with private land developers, civic leaders, and officials of public agencies that do specialized planning. They may prepare materials for community relations programs, speak at civic meetings, and appear before legislative committees to explain and defend their proposals.

In small organizations, urban planners must be able to do several kinds of work. In large organizations, planners usually specialize in areas such as physical design, community relations, or the reconstruction of run-down business districts.

Places of Employment

About 12,000 persons—over 90 percent of them men—were urban planners in 1972. Most work for city, county, or regional planning agencies. A growing number are employed by States or by the Federal Government.

Many planners do consulting work, either part time in addition to a regular job, or full time working

Urban planners discuss community plans.

for a firm that provides services to private developers or government agencies. Urban planners also work for large land developers or research organizations and teach in colleges and universities.

Training, Other Qualifications, and Advancement

Employers often seek workers who have advanced training in urban planning. Two years of graduate study in city planning, or the equivalent in work experience, are required for most entry jobs in Federal, State, and local government agencies. However, some people who have bachelor's degrees in city planning, architecture, landscape architecture, or engineering may qualify for beginning positions.

In 1972, about 60 colleges and universities gave a master's degree in urban planning. Although students holding a bachelor's degree in architecture or engineering may earn a master's degree after 1 year, most graduate programs in urban planning require 2 or 3 years to complete. Graduate students spend considerable time in workshops or laboratory courses learning to analyze and solve urban planning problems. Students often are required to work in a planning office part time or during the summer while they are earning the graduate degree.

Candidates for urban planner jobs in Federal, State, and local government agencies frequently must pass civil service examinations to become eligible for appointment. These examinations usually are advertised nationally and have no residence restrictions.

Planners must be able to think in terms of spatial relationships and to visualize the effects of their plans and designs. They should be flexible in their approaches to problems. Planners have to cooperate with others and reconcile different viewpoints to achieve the desired goals.

After a few years' experience, urban planners may advance to assignments where they exercise a high degree of independent judgment such as outlining proposed studies or designing the physical layout of a large development. Some are promoted to jobs as planning directors, who spend much time meeting with officials in other organizations, speaking to civic groups, and supervising other professionals. Further advancement is more difficult at this level and often occurs through a transfer to a large city, where the problems are more complex and the responsibilities greater.

Employment Outlook

Employment opportunities for college graduates who major in city and regional planning are expected to be very good through the mid-1980's. Although the number of graduates has been rising in recent years, the shortage of well-qualified planners is expected to continue. The American Society of Planning Officials estimated that in 1972 over 10 percent of all positions in city, county, and metropolitan areas (city and suburbs) were vacant. Although most openings will be for new jobs, some positions will result from the need to replace planners who leave the profession, retire, or die.

This occupation will grow through the 1980's as more communities seek professional planning help in solving problems created by urbanization and population growth. As urban communities continue to spill into neighboring areas, open spaces for recreation will tend to disappear, smog and traffic problems will multiply, and the need for more and better planned facilities will become acute. The construction of new cities and towns and Federal assistance for slum clearance and urban renewal also will stimulate the demand for urban planners.

Earnings and Working Conditions

In 1972, the average salary for inexperienced urban planners with the bachelor's degree was $9,000 a year; those with the master's degree earned average salaries of $11,000. Planners with the master's degree and 3 to 4 years' experience had median earnings of $15,000 a year.

Salaries of directors of planning depend largely on the size of the city where they work. In 1972, the average salary for a planning director in a city of 10,000 to 25,000 people was $15,600 a year; in cities of over 250,000, the average was $24,000. Consultants earn fees that vary according to their reputation and previous experience.

In early 1973, the usual entrance salary for urban planners in the Federal Government was $11,600 a year. In a few cases, individuals having less than 2 years of graduate work or the equivalent were hired as interns at yearly salaries of $7,700 or $9,500.

Most planners have sick leave and vacation privileges and are covered by retirement and health plans. Although most city planners have a scheduled workweek of 40 hours, they sometimes work in the evenings and on weekends to attend meetings with citizens' groups.

Sources of Additional Information

Facts about careers in planning and a list of schools offering training are available from:

American Institute of Planners, 917 15th St. NW., Washington, D.C. 20005.

American Society of Planning Officials, 1313 East 60th St., Chicago, Ill. 60637.

COMMUNICATIONS RELATED OCCUPATIONS

Communication is important among people, either individually as citizens, workers, or employers, or collectively as a group, organization, or government. It enables them to express their thoughts and ideas, and in turn to understand and interpret thoughts and ideas of others. This section of the *Handbook* describes four occupations that specialize in communications—interpreters, technical writers, newspaper reporters, and radio and television announcers.

Interpreters and technical writers work as intermediaries translating messages for people to understand: Interpreters help people understand languages foreign to them, technical writers help people understand technical information. Newspaper reporters and radio and television announcers inform people about current events and happenings that might interest or affect them. Newspaper reporters gather information on events which they describe, analyze, and interpret in newspapers for rapid dissemination to large numbers of people. Radio and television announcers use electronic communications equipment to tell people of products and services they might obtain, current happenings, and other items of interest.

INTERPRETERS

(D.O.T. 137.268)

Nature of the Work

Interpreters help people of different nations and different cultures overcome the language barriers that separate them by orally translating what has been said by one person into a language that can be understood by others.

There are two basic techniques of interpretation: simultaneous and consecutive. In simultaneous interpretation, the interpreter orally translates what is being said as the speaker continues to talk. This technique requires quickness and fluency, and it is made possible by the use of electronic equipment. Conference interpreters often work in a glass-enclosed booth from which they can see the speaker. While listening through earphones to what is being said, they simultaneously give the translation by speaking into a microphone. People attending the conference who do not understand the language being spoken may tune in to an interpreter's translation by simply pushing a button or turning a dial to get the translation in the language they know. Simultaneous interpretation is generally preferred for large conferences, and the development of portable equipment has extended its use to situations outside of the formal conference setting.

Consecutive interpretation also involves oral translation. However, the speaker and the interpreter take turns speaking. A consecutive interpreter must have a good memory and generally needs to take notes of what is said to be certain to give a complete translation. The chief drawback of consecutive interpretation is that the process is very time-consum-

ing, since the speaker must wait for the translation before proceeding.

Since interpreters are needed whenever and wherever people find language a barrier, their work may involve a variety of topics and situations. They may be used, for example, to explain to a group of foreign visitors various aspects of the American way of life, such as points of political or social interest, or they may be required to interpret highly technical speeches and discussions for medical or scientific gatherings. They may work at the United Nations, or find themselves in a courtroom or escorting foreign leaders or businessmen visiting the United States.

Places of Employment

An estimated 150 persons worked full-time as interpreters in the United States in 1972. The largest single concentration of interpreters was at the United Nations in New York where nearly 80 people held full-time posts. Various other international organizations, located primarily in Washington, D.C., also employed regular staff interpreters. Within the Federal Government, the Departments of State and Justice were the major employers of full-time interpreters.

An estimated 450 persons worked as free-lance interpreters. Free-lance interpreters may work for various employers under short-term contracts. About four-fifths were under contract on a temporary basis to the Department of State and the Agency for International Development to serve as escort interpreters for foreign visitors to the United States. Some of these interpreters worked a great portion of the year; others worked for only a few days. The remainder of the free-lance interpreters constituted the free-lance conference field. These interpreters provided for both the supplementary needs of the international and Federal agencies as well as for periodic, short-term needs of various international conferences which are held in this country. Besides persons who work strictly as interpreters, there are many who in the course of their jobs may do some interpretation work.

About one-half of the Nation's conference interpreters are women; most who work as escort free-lances, however, are men.

Training, Other Qualifications, and Advancement

A complete command of two or more languages is the primary requisite for becoming an interpreter. Interpreters must be able to call to mind instantaneously words or idioms corresponding to the foreign ones. An extensive working vocabulary and absolute ease in making the transition from one language structure to another are necessary.

Students who want to become interpreters should acquire expertise in several languages. Interpreters who work at the United Nations, for example, must know at least three of the five official U.N. languages, which are English, French, Spanish, Russian, and Chinese. Portuguese and, to some extent, Japanese and German are also of value to interpreters in the United States.

Two schools in the United States offer programs specifically geared to interpreter training. Both require foreign language proficiency upon entry. The Georgetown University School of Languages and Linguistics in Washington, D.C. has a 1- or 2-year course of study leading to a Certificate of Proficiency. Applicants to Georgetown University must qualify on the basis of an oral aptitude test and satisfactory performance in a basic first-year college program. The Monterey Institute of Foreign Studies in Monterey, California, offers a 2-year program leading to a master's degree in Language and International Studies and a certificate from the Department of Translation and Interpretation. Applicants to the Monterey Institute must have a bachelor's degree with a language major, or its equivalent. Students also must pass a qualifying examination for the Interpreters Certificate Program.

Many individuals qualify for positions as interpreters principally on the basis of their foreign backgrounds. Consecutive interpreters, for example, employed by the Immigration and Naturalization Service of the U.S. Department of Justice serve primarily in interpreting legal proceedings, such as hearings for aliens. Extensive experience and a broad education are not as crucial in the performance of their duties as these same factors are for other types of interpretation.

Besides being thoroughly competent in languages, interpreters are expected to be generally well informed on a broad range of subjects, often including technical subjects such as medicine or scientific or industrial technology. Work as a translator may serve as a useful background in maintaining an up-to-date vocabulary in various specialized or technical areas. The experience of living abroad also is very important for an interpreter.

Although there is no standard requirement for entry into the profession, a university education usually is considered essential.

People interested in becoming interpreters should be articulate speakers and have good hearing. The tensions of the job dictate that they have emotional stamina. The exacting nature of this profession demands quickness, alertness, and con-

stant attention to accuracy. Working with all types of people requires good sense and tact. It is essential that interpreters maintain confidentiality in their work and that they give honest interpretations.

Advancement in the interpreting field is generally based on satisfactory service. There is some advancement from escort-level interpreting to conference level work.

Employment Outlook

Employment of full-time interpreters is expected to remain stable through the mid-1980's. Past experience has shown that any slight or sporadic increase in the demand for interpreters could be met by the existing flexible pool of free-lances. Almost all new openings for interpreters, therefore, should result from the need to replace those who retire, die, or leave the field for other reasons. Interpreters may expect to face competition for the limited number of positions. Only those who are highly qualified will find favorable employment opportunities.

Qualified interpreters also may find work abroad. For example, the demand for interpreters in Europe, where language represents a significant barrier to communications, is greater than in the U.S.

People who have linguistic abilities also may find employment opportunities as translators. In fact, many interpreters find the ability to do translation work, if not requisite, an occupational asset. Foreign language competence also is important for careers in the fields of foreign service, international business, and language education.

Earnings and Working Conditions

Salaries of interpreters depend upon the type of interpreting done as well as the ability and performance of the individual. The tax-free annual starting salary for conference interpreters at the United Nations was $9,274 in early 1973. Outstanding U.N. interpreters could expect to earn more than $20,000. Beginning salaries for interpreters in various other international organizations were about $9,000 a year, according to the limited information available. In addition, international organizations often paid supplementary living and family allowances.

Junior interpreters who worked for the U.S. Department of State received salaries ranging from $9,520 to $11,614 a year in early 1973. Starting salaries ranged somewhat lower for Government interpreters with limited education, experience, or interpreting skills.

In the free-lance field, interpreters are paid on a daily basis. Conference interpreter salaries ranged from about $80 to $100 a day in early 1973, depending on experience. The U.S. Department of State paid a daily salary of $90. The pay for interpreters at technical and scientific conferences, which generally convene only once a year for a few days, ranged from $100 to $125 a day.

Free-lance escort interpreters received salaries ranging from about $30 to over $50 a day, based on the individual's skill and prior performance. Interpreters on assignment usually could expect to be paid for a 7-day week. Interpreters are paid transportation expenses by the employing agency and also receive a subsistence allowance to cover the cost of accommodations, meals, and other expenses incidental to their assignments.

The conditions under which interpreters work vary widely. In free-lancing, there is little job security because of demand fluctuations, and the duration of various free-lance assignments ranges from a few days for a typical conference to several weeks for some escort assignments. Although the hours interpreters work are not necessarily long, they are at times irregular. In some instances, especially for escort free-lances, a great deal of travel to a wide variety of locations is required.

Sources of Additional Information

Information on the interpreting profession is available from:

The American Association of Language Specialists, 1000 Connecticut Ave. NW., Suite 9, Washington, D.C. 20036.

American Society of Interpreters, 1010 Vermont Ave. NW., Room 917, Washington, D.C. 20005.

For information on entry requirements and courses of study at the two schools offering specialized programs for interpreters contact:

Division of Interpretation and Translation, School of Languages and Linguistics, Georgetown University, Washington, D.C. 20007.

Department of Translation and Interpretation, Monterey Institute of Foreign Studies, P.O. Box 1978, Monterey, Calif. 93940.

Information about employment opportunities is available from:

Language Services Division, U.S. Department of State, Washington, D.C. 20520.

Secretariat Recruitment Service, United Nations, New York, N.Y. 10017.

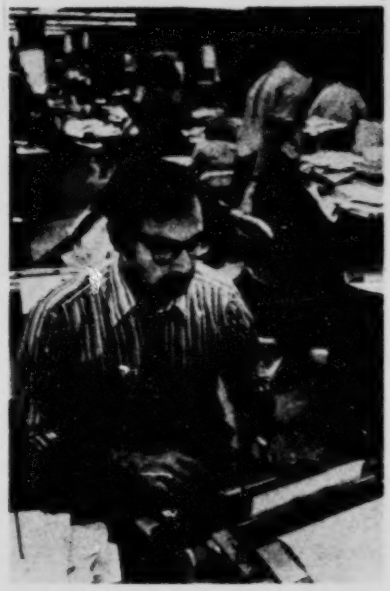
NEWSPAPER REPORTERS

(D.O.T. 132.268)

Nature of the Work

Newspaper reporters gather information on current events and use it to write stories for publication in daily or weekly newspapers. In covering events, they may interview people, review public records, attend news events, and do research. As a rule, reporters take notes or use electronic recording devices while collecting facts, and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone their information or stories to other staff members known as "rewrite men", who write or transcribe the stories for them them.

Large dailies frequently assign some reporters to "beats," such as police stations or the courts, to gather news originating in these places. General assignment reporters handle various types of local news, such as a story about a lost child or an obituary of a community leader. Specialized reporters with a background in a particular subject interpret and analyze the news in fields such as medicine, politics, science, education, business, labor and religion.



Reporters on small newspapers may not only cover all aspects of local news, but also may take photographs, write headlines, lay out pages, and write editorials. On some small weeklies, they also may solicit advertisements, sell subscriptions, and perform general office work.

Places of Employment

About 39,000 persons, two-fifths of them women, worked as newspaper reporters in 1972. The majority of reporters work for daily newspapers; others work for weekly papers, press services, or for a group of newspapers called a syndicate.

Reporters work in cities and towns of all sizes. Of the 1,750 daily and 7,600 weekly newspapers, the great majority are in medium-sized towns. However, most reporters work in cities, since big city dailies employ many reporters, whereas a small-town paper generally employs only a few.

Training, Other Qualifications, and Advancement

Most newspapers will consider only applicants who have a college education. Graduate work is increasingly important. Many editors prefer graduates who have a degree in journalism, which usually provides a liberal arts education along with professional journalism training. Some editors consider a liberal arts degree sufficient. Other editors prefer applicants who have a liberal arts bachelor's degree and a Master's degree in journalism. Although talented writers having little or no academic training beyond high school sometimes become reporters on city newspapers, most reporters without college training begin on rural, small-town, or suburban papers.

Bachelor's degree programs in journalism are available in over 200 colleges; about two-thirds of these schools have separate departments or schools of journalism. About three-fourths of the courses in a typical undergraduate journalism curriculum are in liberal arts. Journalism courses include reporting, copyreading, editing, feature writing, and the history of journalism.

More than 250 junior colleges offer journalism programs. Credit secured in most is transferable to a 4-year college program in journalism. Some junior colleges also offer programs especially designed to prepare the student directly for employment as a general assignment reporter on a weekly or small daily newspaper. The Armed Forces also provide some training in journalism.

A graduate degree in journalism was offered by 78 schools in 1972. Many of them offer a doctor's degree in mass communications.

Young people who wish to prepare for newspaper work through a liberal arts curriculum should take English courses that include writing, as well as subjects such as sociology, political science, economics, history, psychology, and speech. Ability to read and speak a foreign language and some familiarity with mathematics also are desirable. Those who look forward to becoming technical writers or reporters in a specialized field such as science, should concentrate on course work in their subject-matter areas. (See statement on Technical Writers). Skill in typing generally is desirable since reporters usually must type their own news stories. On small papers, knowledge of news photography also is valuable.

The Newspaper Fund and individual newspapers offer summer

internships that provide college students with an opportunity to practice the rudiments of reporting or editing. In addition, more than 2,150 journalism scholarships, fellowships, assistantships, and loans were awarded to college journalism students by universities, newspapers, and professional organizations in 1972.

News reporting involves a great deal of responsibility, since what a reporter writes frequently influences the opinion of the reading public. Reporters should be dedicated to serving the public's need for accurate and impartial news. Although reporters work as part of a team, they have an opportunity for self-expression. Important personal characteristics include a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-pace life.

Some who compete for full-time reporter jobs find it is helpful to have had experience as a "stringer"—a part-time reporter who covers the news in a particular area of the community for a newspaper and is paid on the basis of the stories printed. Experience on a high school or college newspaper also may be helpful in getting a job.

Many beginners start on weekly or on small daily newspapers where they acquire a broad range of reporting experience. Some college graduates are hired by large city papers as general assignment reporters while others start as copy editors. Beginning reporters usually are assigned duties such as reporting on civic and club meetings, summarizing speeches, writing, obituaries, interviewing important visitors to the community, and covering police court proceedings. As they gain experience, they may report more important events, cover an assigned "beat," or specialize in a particular field.

Newspaper reporters may advance to reporting for larger papers or press services and newspaper syndicates. Some experienced reporters become columnists, correspondents, editorial writers, editors, or top executives; these positions represent the top of the field and competition for them is keen. Other reporters transfer to related fields such as public relations, writing for magazines, or preparing copy for radio and television news programs.

Employment Outlook

Beginners with exceptional writing talent are expected to find favorable employment opportunities through the mid-1980's. Others, however, will face strong competition for jobs, especially on large city dailies. Employment opportunities for reporters able to handle news about highly specialized or technical subjects are expected to be favorable.

Weekly or daily newspapers located in small towns and suburban areas are expected to continue to offer the most opportunities for beginners entering newspaper reporting. Openings arise on these papers as reporters gain experience and transfer to reporting jobs on larger newspapers or to other types of work. Beginning reporters able to help with photography and other specialized aspects of newspaper work and who are acquainted with the community are likely to be given preference in employment on small papers.

Inexperienced persons with good educational backgrounds and a flair for writing may find some openings as reporter trainees on large city dailies. Some opportunities may continue to be available for young people to enter clerical jobs and advance to reporting. In addition to jobs in newspaper reporting, recent college graduates who have journalism training may enter related fields such as advertising, public relations, trade and technical publishing, and radio and television. Some job opportunities also will be found in teaching journalism.

The broad field of mass communication, which has grown rapidly in recent years, is expected to continue to expand due to rising levels of education and income; increasing expenditures for newspaper, radio, and television advertising; and a growing number of trade, technical journals, and various types of company publications. As newspapers share in this growth, employment of reporters is expected to increase moderately. Most job openings, however, will continue to arise from the need to replace reporters who are promoted to editorial or administrative positions, transfer to other fields of work, retire, or leave the profession for other reasons.

Earnings and Working Conditions

Reporters working for daily newspapers having contracts negotiated by The Newspaper Guild averaged starting salaries of $7,600 in late 1972. Starting annual salaries ranged from less than $5,200 at the large metropolitan dailies. In general, earnings of newspaper reporters in 1972 were above average earnings received by nonsupervisory workers in private industry, except farming.

Minimum salaries of reporters having 4 or 5 years experience who worked for daily newspapers with Guild contracts averaged $12,300 in 1972. The minimums ranged from $8,800, paid by the smallest dailies, to more than $15,600 paid by the largest. Many reporters were paid salaries higher than these minimums, however. Reporters working for national wire services received annual salaries of at least $14,000.

Most newspaper reporters generally work a 5-day, 35 or 40 hour week. Reporters working for morning papers usually start work in the late afternoon and finish at about midnight. Most reporters also receive benefits such as paid vacations, group insurance, and pension plans.

Sources of Additional Information

Information about opportunities for reporters with daily newspapers is available from:

American Newspaper Publishers' Association, P.O. Box 17407, Dulles International Airport, Washington, D.C. 20041.

Information on opportunities in the newspaper field and starting salaries of journalism graduates, as well as a list of journalism scholarships, fellowships, assistantships, and loans available at colleges and universities is available from:

The Newspaper Fund, Inc., Box 300, Princeton, N.J. 08540.

Information on union wage rates is available from:

The Newspaper Guild, Research Department, 1125 15th St. NW., Washington, D.C. 20005.

For general information about jobs in journalism contact:

American Council on Education for Journalism, School of Journalism, University of Missouri, Columbia, Mo. 65201.

Association of Education in Journalism, 5172 Vilas Community Hall, University of Wisconsin, Madison, Wisc. 53706.

Sigma Delta Chi, 35 East Wacker Dr., Chicago, Ill. 60601.

Information on the opportunities for women in newspaper reporting and other communications fields is available from:

Women In Communications, Inc., 8305 A Shoal Creek Blvd., Austin, Tex. 78758.

Names and locations of daily newspapers and a list of schools and departments of journalism are published in the *Editor and Publisher International Yearbook*, available in public libraries and in most large newspaper offices.

RADIO AND TELEVISION ANNOUNCERS

(D.O.T. 159.148)

Nature of the Work

Most radio announcers act as disc jockeys, introducing recorded music, presenting news and commercials, and commenting on other matters of interest to the audience. They "ad-lib" much of the commentary, working without a detailed script. They also may operate the control board, sell time for commercials, and write commercial and news copy. In large stations, however, other workers handle these jobs. (See statement on the radio and television broadcasting industry elsewhere in the *Handbook*.)

Announcers employed by television stations and large radio stations usually specialize in particular kinds of programs such as sports, news, or weather. They must be thoroughly familiar with their areas of specialization. If a written script is needed for parts of the program, the announcer may do the research and writing. Announcers frequently participate in community activities. A sportscaster, for example, might be the master of ceremonies at a touchdown club banquet or greet customers at the opening of a new sporting goods store. Some announcers become well-known and highly-paid personalities.

Places of Employment

About 17,000 staff announcers were employed full-time by commercial radio and television broadcasting stations in 1972. More than 80 percent of them worked in radio broadcasting. The average commercial radio or television station employed 2 announcers, although larger stations sometimes employed 4 or more. In addition to staff announcers, several thousand freelance announcers sell their services for individual assignment to networks and stations, or to advertising agencies and other independent producers.

Training, Other Qualifications, and Advancement

Announcers must have a pleasant and well-controlled voice, a good sense of timing, and excellent pronunciation. Correct English usage and a knowledge of dramatics, sports, music, and current events improve chances for success. The most successful announcers have a combination of personality and showmanship that makes them attractive to audiences.

High school courses in English, public speaking, dramatics, and foreign languages, plus sports and music hobbies, are valuable background for prospective announcers. A number of vocational schools offer training in announcing, and many universities offer courses of study in the broadcasting field. A college liberal arts education also provides an excellent background for an announcer.

Most announcers get their first broadcasting jobs in small stations. Because announcers in small stations sometimes operate transmitters, prospective announcers often obtain an FCC Radiotelephone First Class Operator License which enables them to operate a transmitter and, therefore, makes them much more useful to these stations. Announcers more frequently

operate control boards, for which only a Third Class License is required. (For information on how to obtain such licenses, see the statement on broadcast technicians elsewhere in the *Handbook*.)

Announcers usually work in several different stations in the course of their careers. After acquiring experience at a station in a small community, an ambitious and talented announcer may move to a better-paying job in a large city. An announcer also may advance by getting a regular program as a disc jockey, sportscaster, or other specialist. In the national networks, competition for jobs is intense, and announcers usually must be college graduates and have several years of successful announcing experience before they are given an audition.

Employment Outlook

The employment of announcers is expected to increase moderately through the mid-1980's as new radio and television stations are licensed. Employment growth, however, will be limited by the increased use of automatic programing. Most job openings in this relatively small occupation will result from the need to replace experienced announcers who transfer to other occupations, retire, or die.

It will be easier to get an entry job in radio than in television because of the greater number of radio stations, especially small stations, that hire beginners. However, the great attraction of this field for young persons, and its relatively small size will result in keen competition for entry jobs.

Earnings and Working Conditions

Salaries of beginning announcers in commercial television ranged from about $140 to $200 a week in 1972, and those of experienced announcers ranged from about $175 to $260, according to information from a small number of union contracts. Some well-known announcers earn much more. As a rule, salaries increase with the size of the community and the station, and salaries in television are higher than those in radio. Announcers employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most announcers in large stations work a 40-hour week and receive overtime pay for work beyond 40 hours. In small stations, many announcers work 2 to 8 hours of overtime each week. Working hours consist of both time on the air and time spent in preparing for broadcasts. Evening, night, weekend, and holiday duty occurs frequently since many stations broadcast 24 hours a day, 7 days a week.

Most announcers receive paid vacations. Typically, vacations range from 1 to 4 weeks, based on length of service.

Working conditions are usually pleasant because of the variety of work and the many personal contacts that are part of the job. Announcers also receive some satisfaction from becoming well known in the area their station serves.

Sources of Additional Information

General career information may be obtained from:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

Corporation for Public Broadcasting, 888 16th St. NW., Washington, D.C. 20006.

TECHNICAL WRITERS

(D.O.T. 139.288)

Nature of the Work

The many technical and scientific developments and new consumer products of recent years have created a need for skilled writers to interpret these developments and write instructions for their use. Technical writers organize, write, and edit materials about science and technology in order to establish clearer communication between scientists, engineers, and other technical specialists, and the users of their information—technicians, repairmen, scientists, engineers, executives, or housewives. Their writing must always be clear and easy to follow, and when it is to be used by specialists it often must include technical detail and a highly specialized vocabulary. Technical writers usually arrange for the preparation of tables, charts, illustrations, and other artwork, and may work with technical illustrators, draftsmen, or photographers.

Before starting a writing assignment, technical writers usually learn as much as they can about their subject. This process involves studying reports, reading technical journals, and consulting with the engineers, scientists, and other technical personnel who have worked on the project. Then they prepare a rough draft that may be revised several times before it is accepted in final form.

The technical writer's product takes many forms, such as publicity releases on a company's scientific or technical achievements, or on manufacturers' contract proposals to the Federal Government. It may be manuals that explain how to operate, assemble, disassemble, maintain, or overhaul components of a missile system or a home appliance. Technical writers may also write for scientific and engineering periodicals and for popular magazines.

Places of Employment

An estimated 20,000 technical writers and editors were employed in 1972. Most technical writers are employed in the electronic and aerospace industries. Many work for research and development firms or for the Federal Government—mainly in the Departments of Defense and Agriculture, the Atomic Energy Commission, and the National Aeronautics and Space Administration. Some work in firms that specialize in technical writing. Others are in business for themselves as freelance technical writers.

Technical writers are employed all over the country, but primarily in the Northeastern States, Texas, and California. They are concentrated in the Washington, D.C., Los Angeles-Long Beach, Houston, Fort Worth-Dallas, Chicago, New York, Boston, St. Louis, Kansas City, Denver, and Philadelphia metropolitan areas.

Training, Other Qualifications, and Advancement

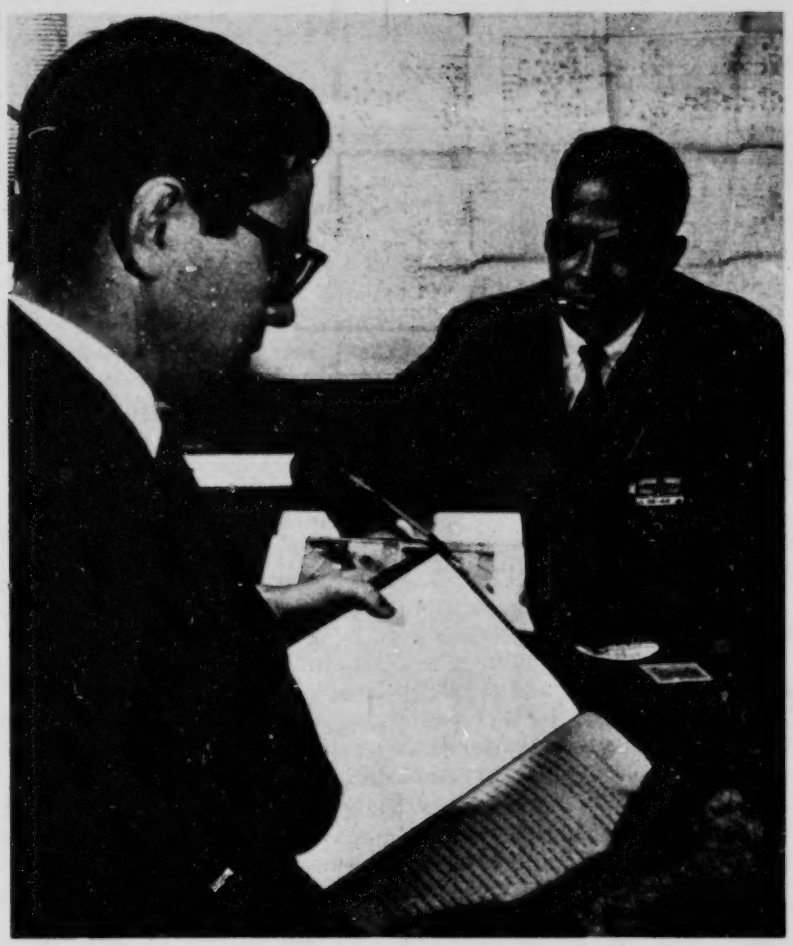
A bachelor's degree is generally required in order to begin work in this field, although talented and experienced writers who have less academic training may qualify.

Some employers prefer applicants with degrees in engineering or science who have had courses in writing. Others seek graduates who majored in English or journalism, and who have taken some courses in science and technical subjects. Regardless of which major they prefer, all employers require a knowledge of science and technology and place great empasis on writing skills.

In 1972, 10 colleges and universities offered 4-year programs leading to a bachelor's degree in technical writing, technical communication, or technical journalism; three schools offered graduate work and degrees in the field. In addition, many schools provide professional education leading to a bachelor's degree in journalism; most of these offer at least one course in technical writing as part of the regular curriculum. Almost all colleges, and some engineering schools, offer English courses to sharpen writing skills. Some conduct summer workshops and short-term seminars for technical writers. Young people who plan to enter this field can gain valuable experience while still in school by working as editors or writers for their high school or college newspapers.

Besides having writing skills, technical writers should think logically and like to do detailed and accurate work. They should be able to work and talk with others, since they often work as part of a team. At other times, however, technical writers must work alone with little or no supervision, so they should be able to accept responsibility. Technical writers also should like working with ideas and seeing the results of their work.

Beginners often assist experienced technical writers by doing library research, and by editing and preparing drafts of reports. Experienced writers in organizations that have large technical writing staffs may advance to positions of technical editors or other supervisory and administrative positions. After gaining experience and contacts, a few may go into business for themselves. It also is possible to advance by becoming a specialist in a particular scientific or technical subject. These writers sometimes prepare syndicated newspaper columns or articles for popular magazines.



Technical writers often work as part of a team.

operating and maintenance instructions for consumer products.

However, since many technical writers work in defense- and space-related activities, including research and development, future job opportunities are related to government expenditures in these areas. Through the mid-1980's, R&D expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's, reflecting the reduced importance of the space and defense components of R&D expenditures.

Technical writers, as discussed in this statement, include only those persons whose primary job is to write about, interpret, and edit technical subject matter. Those primarily employed as scientists, engineers or other technical specialists who may do a considerable amount of writing are not covered here. As technology becomes increasingly complex, more writing assignments may require technical and scientific knowledge equivalent to that of an engineer or scientist.

Technical writers who have training in journalism may find opportunities in other fields that employ writers such as advertising, public relations, trade publishing, and television and radio broadcasting.

Employment Outlook

Employment of technical writers is expected to increase moderately through the mid-1980's. Additional opportunities will result from the need to replace those who die, retire, or transfer to other occupations. Experienced technical writers and beginners who have good writing ability and the appropriate education should find opportunities for employment. Those with only minimum qualifications, however, may face stiff competition for beginning jobs.

Requirements for technical writers are expected to increase because of the need to put the growing amount of scientific and technical information into language that can be understood by managers for decision-making and by technicians for operating and maintaining complex industrial equipment. Since many products will continue to be assembled from components manufactured by different companies, technical writers also will be needed to describe, in simple terms, how the components fit together. Others will be needed to improve and simplify

Earnings and Working Conditions

Technical writers had high earnings in 1972, compared with average earnings for nonsupervisory workers in private industry, except farming. Inexperienced technical writers having bachelor's degrees received starting salaries ranging from $6,000 to $8,500 a year; those with moderate experience earned from $8,500 to $12,000 a year; highly experienced writers earned from $12,000 to $16,000; and those in supervision and

management, $20,000 or more. Salaries of technical writers depend not only on ability and previous experience, but also on the type, size, and location of their employing firm. Earnings of freelance writers vary greatly and depend on the writer's ability and reputation.

In the Federal Government in early 1973, inexperienced technical writers with a bachelor's degree and about five science courses could start at either $7,694 or $9,520 a year, depending on their college grades. Those with two years of experience could start at $11,614 and with three years of experience, $13,996.

Technical writers may work under considerable pressure, frequently working overtime when a deadline has to be met on a publication or report.

Sources of Additional Information

For information about careers in technical writing, contact:

Society for Technical Communications, Inc., Suite 421, 1010 Vermont Ave. NW., Washington, D.C. 20005.

THE OUTLOOK FOR INDUSTRIES

616/617

AGRICULTURE

The United States is in the midst of an agricultural revolution with a tremendous impact on the employment outlook in agriculture.

In brief, fewer and fewer farmers and farmworkers are producing more and more of America's farm products. Employment on U.S. farms has declined from 7.2 million in 1950 to 3.4 million in 1972 of whom about one in five was a woman. By the mid-1980's only 1.9 million persons are expected to be working on U.S. farms. Less than a million of those positions will be filled by hired workers.

The reason is simply that the typical farmer today can produce far more than his predecessors. A modern corn farmer, for instance, will use six-row or eight-row field equipment, including tractors, costing a total of about $22,000, along with trucks with field implements costing about $18,000, a self-propelled combine harvester worth $18,000, and grain drying equipment valued at about $18,000. To make this high-capacity equipment profitable, he may need to grow 600 to 1,000 acres of corn. His father, using 2-row equipment, probably earned a good living from 320 acres. His grandfather, using horsedrawn equipment, could work only about 120 acres.

Accompanying this expansion of farms and equipment, there has been a vast reduction in the number of man-hours required to produce most major farm commodities. In 1910, it took 135 man-hours to produce 100 bushels of corn; today it takes 7 hours. Man-hours needed to produce 100 bushels of wheat dropped similarly from 106 to 9, in the same period. Though it took 31 hours to produce 100 pounds of turkey in 1910, it takes only 1.1 today.

Although employment on farms will continue to decline, opportunities for employment in agribusiness related occupations is expected to increase. As farms increase in size and complexity, more and more custom services will be used by the remaining farmers. Operating the equipment and providing other services to the farmer often requires special training and skills. Thus, there will continue to be a wide range of occupations requiring technical knowledge below that acquired at the college level.

At the college level, persons with degrees in agriculture will be needed to fill jobs as buyers for packers and processors, in advertising and public relations work, market reporting, and in managerial positions in farm cooperatives, food chains, dairy product distributors, agrichemical manufacturers, and farm credit agencies. College graduates also will have opportunities to work as teachers of vocational agriculture, agricultural extension agents, and rural development planners.

Opportunities on Farms

Since productivity in farm production is growing so rapidly, the number of jobs in farming is declining steadily. The increasing productivity of our farmers has been a boon to consumers and the nonfarm economy—but today farmers find themselves in an industry that requires ever-larger farms, more investment, and better management to stay in business.

Management is the key to success in modern farming. Today's farmer needs a much higher level of knowledge and skills than did his predecessor. For example, the dairy farmer used to feed each cow an amount of grain based on the amount of milk she had produced the previous day or week. The modern dairyman feeds his cows on the basis of their potential—"pushing" potential high-performance cows to their limits, cutting back on expensive feed for cows that already have peaked out. Figuring the potential is a much more difficult technique than weighing milk.

Similar management problems face the modern farmer in most areas—which is why college training is becoming the rule rather than the exception for the young "commercial" farmer. It gives him the technical basis that he needs to keep up with new developments in research and technology and to apply them intelligently on his own farm. Biology, engineering, chemistry, and agronomy—not to mention economics marketing and accounting—are part of the necessary kit of tools for a successful farmer today.

Capital requirements form another barrier the beginning farmer must overcome. The average commercial farm in 1969 had 530 acres, with a value of more than $103,000 in land and buildings alone. Regionally, the value of commercial farms varies from an average of $46,000 in

Appalachia to nearly $300,000 in the Pacific region.

For the person who has the training, the capital, and the management ability, the modern farm can offer much higher incomes than the old-style farm ever did.

About 222,000 large farms in the United States sold farm products valued at $40,000 or more during 1969, averaging $37,503 in net income. Another 331,000 medium-sized farms sold farm products at an average income of $20,000 to $39,999 in 1969, averaging $10,466 in net income.

Together, these two groups—the large- and the medium-sized—made up nearly 20 percent of U.S. farms and accounted for nearly 72 percent of U.S. farm sales in 1969. These two groups represent the expanding sector of U.S. agriculture.

Although an additional 395,000 small-sized farms had gross sales of $10,000 to $19,999 in 1969, these averaged only $6,481 in net income. Most of these farm owners would need to expand their operations or else supplement their incomes with off-farm work to equal the income they could get in some other type of employment.

Agriculture production still offers challenging and rewarding careers, with larger incomes and better living conditions than it used to—but it offers them to fewer and fewer people.

Many people, of course, prefer living in the country, and modern transportation and communications, public services, and household and farming appliances have eliminated most of the disadvantages that attended rural living a generation or two ago.

Although the number of opportunities in farming is shrinking, the number of jobs is increasing in farm-related industries that supply products and services to the farmer and that handle the processing and marketing activities for farm products. These industries have a continuing need for young people who have a farming background—plus training for their specialized functions.

Training Opportunities Available for Farming

A good initial background in farming can be obtained by growing up on a successful farm. Necessary experience also may be gained by working as a closely supervised tenant or hired worker on a successful farm. In addition, college training in agriculture and in agricultural business management are of substantial value to the modern farmer.

Several types of vocational training are available under federally assisted programs. Training is offered in the following ways:

1. High school courses in agriculture.
2. Short courses for young farmers at colleges of agriculture, including intensive training in farm planning, farm structures, construction, welding and related shop and repair work, as well as instruction in crop production, livestock feeding and management, recordkeeping, and other aspects of farming.
3. Adult evening classes (or day classes in off-seasons) that provide intensive instruction in subjects such as land and soil management, crop and livestock production, new technology and equipment, and financial management.

The most significant sources of information and guidance available to farmers are the services provided by the land-grant colleges and universities and the U.S. Department of Agriculture. These services include research, publications, teaching, and extension work. The county agricultural agent is often the best contact for the young person seeking advice and assistance in farming. The Farmers' Home Administration system of supervised credit is one example of credit facilities combined with a form of extension teaching. Organized groups, such as the Future Farmers of America and the 4-H Clubs, also furnish valuable training to young farm people.

Opportunities on Specific Types of Farms

Although the number of farms and farm jobs is decreasing, desirable and rewarding opportunities occur in agriculture production and related pursuits. The decision to enter farming may be made simply because an opening exists on the family farm or on a farm nearby. To be successful, a young person should appraise carefully the requirements in specific types of farm operations, and the prospects for success in them, taking into consideration aptitudes, interests, preferences, experience, knowledge, and skills in directing labor and handling livestock and machinery. Young people also must consider family labor supply and financial resources, as the labor and capital requirements for an operation of adequate size vary widely from one type of farm to another.

A realistic decision to go into farming can be made only in terms of a particular area or community. This section evaluates, from an occupational standpoint, some of the more common types of farm. The accompanying table gives illustrative data on size of farm, capital requirements and net farm incomes received by operators of typical or representative farms in various parts of the country. Many farms are larger than these and offer more return than is shown here. Some are smaller and offer the operator little income or opportunity to improve his status without major changes. On most of the farms, the major part of the work is done by the farm operators and their families. Whereas, some of the smaller farms hire workers only during the peak labor sea-

son, large ones often use hired labor the whole year.

The figures in the table on capital invested mean that the operator controls or uses resources valued at that amount. Many farmers supplement their own capital with borrowed funds; others rent part or all of the land they use, thus reserving more of their funds for the purchase of livestock, feed, machinery, and equipment. Still others have partners who provide most of the working capital. For example, many farmers who raise broilers are in partnership with a feed dealer.

No brief general statement can be made about specialization versus diversification in farming operations that would apply in all parts of the country. The general trend favors more specialized farming. Farms that produced many products a generation ago now may produce only two or three. Efficient production of most farm products requires a substantial investment in specialized equipment. If the farm operator is to receive the full benefit from his investment, he must produce on a large scale. Two other factors contributing to specialization are the increased emphasis on quality of farm products, and the greater knowledge and skill required for effective production. Few farmers, however, find it advantageous to produce only one product. The main reasons for producing more than one product are the desirability of spreading price and production risks, the more effective use of labor (particularly family labor), and the fuller utilization of most other resources than can be realized in a one-product system.

Dairy Farms

Dairy farms are common in most parts of the country. Despite modern methods of processing and transporting milk, production is still concentrated near the large population centers particularly in the Northeast and the Great Lakes States. However, many areas in the far West and the South are becoming large producers of dairy products. Many of the newer type large dairy farms are "drylot" or barn operations with little or no pasture land. Some are cooperatively operated. However, on typical dairy farms in the Lake States, and to a lesser extent in the Northeast, crops are important, often requiring operators to hire or exchange labor at harvest time. There is work every day throughout the year on dairy farms, so that effective use can be made of labor, and a regular force can be occupied most of the time.

Though cows have to be milked daily, most people do not like to be "tied down" 7 days a week. As a result, the current practice in many areas is to arrange work schedules so each person can have some time off during the month. Dairying is also a good choice for the person who likes to work with mechanical equipment. Dairy farmers who produce much of their own feed find variety in the many different jobs that must be done.

The dairyman's sales and income are distributed more evenly throughout the year than other farmers'. Moreover, the prices he receives are less subject to year-to-year fluctuations than are prices received by operators in most other types of farming. The accompanying table shows the average net farm income on dairy farms in central and southeastern Wisconsin for 1970–71.

Compared with farmers in most other areas, dairy farmers in the more concentrated milksheds of the Northeast (such as the dairy farms in the Central Northeast shown in the table) generally have larger herds, purchase a larger proportion of their feed, and buy rather than raise their herd replacements. In the most highly specialized producing area near Los Angeles, dairy farms are drylot operations. They are quite small in acreage, but large in milk production and number of cows milked. No crops are produced; these dairy operators buy their entire feed requirements from outside the area. Most of the cows are bought at freshening time and are replaced when their lactation period is completed.

Net farm income represents the return to the farm operator and his family for their labor as well as the return on the capital invested in the farm business—provided the operator owns his land and is free from debt. If he rents part or all his farm, not all the net farm income is available for family living; part of it must be used for rent. Similarly, the farmer who is in debt must deduct interest costs and payments on the principal.

Livestock Farms and Ranches

A general livestock farm is a good choice for the farmer who is interested in working with livestock and mechanical equipment and is appropriately skilled. Many farmers prefer general livestock farms—such as the hog-beef feeding farms in the Corn Belt (see table)—because during much of the year they require fewer chores than dairy farms. The timing of daily hog and beef cattle farm chores also is more flexible than the milking schedule on dairy farms. Practically all of the regular labor on most general livestock farms is provided by the operator and his family. During some seasons of the year, full-time or part-time work exists for several members of the family, but, these are usually offset by slack labor periods when there is time for leisure or nonfarm activities.

The livestock farmer's income is not as well distributed throughout the year as the dairyman's, and it is less likely to be uniform from year to year, as well. Financial and management problems result, increasing the risks of operation. Moreover, on farms of limited acreage—often found in the Eastern States—the level of income from general livestock farming is usually lower than from a dairy herd on similar acreage.

Most hog producers have their own breeding stock, and raise the pigs they fatten for market. Some farmers who fatten cattle and sheep also raise their own stocks of calves and lambs. But most of the cattle and sheep fattened and marketed by the livestock farmer are bred and raised originally by someone else—usually the livestock rancher of the West. The accompanying table includes data for four types of Western livestock operations: Northern Plains and Northern Rocky Mountain cattle ranches, sheep ranches in Utah-Nevada, and cattle ranches in the Southwest. In these areas of low rainfall, the main source of feed is range grass, and several acres are required to provide enough pasture for their stock; ranchers spend much of their time in the saddle, truck, or jeep managing their herds. Much of this range comes from the public domain. Except where irrigation is available, feed crops usually are not grown.

Poultry Farms

One-third of the farmers in the United States raise some poultry, but in 1969, about 2 percent were classified as poultry farmers. Many poultry farms concentrate on egg production. Most of the larger and more specialized of these farms are in the Southeast, in the Northeast and in California. Many highly concentrated centers of broiler production are east of the Mississippi River, and a few are on the West Coast. Turkey producers also are specialized. A concentration of specialized producers of ducks is located in Suffolk County, Long Island, New York.

Most specialized poultry producers, particularly those who produce broilers or large laying flocks, produce crops for sale. They purchase supplies of special poultry feeds and laying mash. Commercial poultry farmers in New Jersey, for example, buy all their feed. The typical broiler producer in Maine, the Delmarva (Delaware, Maryland, Virginia) peninsula, and Georgia devotes almost all his capital and labor to the production of broilers.

Poultry farming requires specialized skill in handling birds, especially on the part of the operator. The combination of bulk handling of feed and mechanical feeding, a widespread practice, requires little physical strength. For these reasons, poultry farms make considerable use of family help.

Data on average capital investment and net farm income for representative egg producers in New Jersey and broiler operators in Georgia for 1968–69 are given in the table. These averages do not reveal the sharp year-to-year fluctuations in income that occur. Because they have a high proportion of cash costs and a thin margin of profit, relatively small changes in prices of feed, broilers, and eggs can bring about sizable fluctuations in net farm income.

The incomes of most broiler producers, however, are fairly stable because they produce "under contract." Contract production is more widespread in broiler production that in any other major type of farming. Under these arrangements, the financing agency (usually a feed dealer) furnishes the feed, chicks, and technical supervision—almost everything except the buildings, equipment, and the direct production labor. The grower receives a stipulated amount per 1,000 birds marketed, and often a bonus for superior efficiency. Many turkey producers operate under similar contracts, but these arrangements are not nearly so universal for the production of turkeys as for broilers.

Corn and Wheat Farms

For the man who likes working with crops and farm machinery, cash grain farming (growing soybeans, corn, or wheat for sale, not for use as feed) has much to offer. Many people dislike being tied down with daily responsibilities the year around, as with livestock chores. They prefer, instead, to work long days with large laborsaving equipment during the busy seasons, as in soil preparation, planting, and harvesting, and then to have some free time in slack periods.

The table shows the investment required and the recent income experience of some representative cash grain farms. Farms of this type include cash grain farms in the Corn Belt, spring wheat-fallow farms in the Northern Plains, and winter wheat-fallow farms in the Pacific Northwest. Some of these farms—particularly in the Northern Plains—raise some beef cattle for sale as feeders, and a small number keep a few milk cows. However, this livestock production is usually of secondary importance. Many of these cash crop farmers do not raise any livestock.

Two of the main risks faced by the commercial wheat grower are unfavorable weather and low prices. However, crop insurance has reduced the risk of low yields, and Government price support programs have lessened the risk of low prices.

Cotton, Tobacco, and Peanut Farms

In terms of number of farmers, production of cotton, tobacco, and peanuts makes up a large part of the agriculture in the Southeastern and South Central States. These products are grown on farms that range from very small operating units to comparatively large ones. Market competition in these crops has been keen, and many growers have been forced to diversify and enlarge their farms—adjustments which require capital investment. Competition from cotton growers in irrigated areas of the West and Southwest has forced many farmers in the Southeast to discontinue cotton production. Some of them have diversified their operations, and others have found better opportunities in southern industrial expansion.

Crop Specialty Farms

Many farmers throughout the country have unique background, skills, resources, or other advantages for particular kinds of farming chiefly because of their location, home training, or neighborhood practices. They may specialize in the production of a single crop—such as grapes, oranges, potatoes, sugarcane, or melons—or a combination of related specialty crops.

Operators of these enterprises usually employ many seasonal workers and require relatively expensive specialized equipment. They need specific skills many of which can be obtained only through experience. Enterprises of this kind should be undertaken only by persons with considerable experience and some of the special skills and techniques required. An individual having an aptitude for these skills usually can learn them by working a few years as a hired hand on such a specialty farm or as a tenant for a landlord who can give direction and assistance.

Annual returns from these specialty farms usually vary greatly from year to year because of the vagaries of nature and the changes in prices. Operators of these farms who keep abreast of production and marketing conditions are usually well-rewarded for their ability to manage, produce, and market their products.

Table 1. Average size of farm by product and location, capital invested, and net farm income on commercial farms, 1970-71

Type of farms and location	Size of farm as measured by	Land and buildings	Capital invested in —			Net farm income[1]
			Machinery and equipment	Livestock	Crops	Total	
Dairy farms:							
Central New York	40 milk cows	$ 40,000	$18,930	$20,440	$ 8,130	$ 87,500	$16,632
Southeastern Wisconsin	40 milk cows	78,570	19,860	22,080	8,900	129,410	20,290
Egg-producing farms, New Jersey[2]	5,550 layer chickens	43,320	2,730	8,330	0	54,380	10,592
Broiler farms, Georgia[2]	44,600 produced annually	21,640	4,940	860	160	27,600	1,973
Corn Belt farms:							
Hog-beef feeding	280 acres of cropland	148,000	21,000	43,000	21,000	233,000	22,500
Cash grain crop	375 acres of cropland	280,000	34,000	0	3,000	317,000	21,500
Cotton farms:[2]							
Mississippi Delta	900 acres of cropland	453,750	76,450	0	0	530,200	48,700
Southern High Plains, Texas							
Irrigated	870 acres of cropland	413,700	41,000	0	0	454,700	20,350
Nonirrigated	860 acres of cropland	193,750	16,100	0	0	209,850	20,950
Tobacco farms, Coastal Plain, North Carolina[2]	50 acres of cropland	43,860	5,520	680	690	50,750	5,888
Tobacco-livestock farms, Bluegrass area, Kentucky[2]	64 acres of cropland	123,000	7,020	10,520	2,290	142,820	10,998
Wheat-fallow farms:							
Northern Plains	1800 acres of cropland	198,500	40,000	0	0	238,500	23,425
Central Plains	1800 acres of cropland	248,000	40,000	0	0	288,000	31,930
Pacific Northwest	1800 acres of cropland	358,500	50,000	0	0	408,500	29,485
Cattle ranches:							
Northern Plains	307 beef cows	335,460	20,670	93,660	5,170	454,960	28,791
Northern Rocky Mountain	314 beef cows	223,850	19,620	87,340	10,040	340,850	29,378
Southwest	278 beef cows	443,370	12,260	79,370	0	535,000	8,859
Migratory-Sheep Ranches, Utah-Nevada	2025 breeding ewes	134,360	15,150	79,650	1,380	230,540	16,956

[1] The information presented here is on an owner-operated basis, primarily for comparability between types of farm. Net farm income is the combined return to total capital plus return to operator and other unpaid members of the family for their labor and management. No allowance has been made for payment of rent, interest, or mortgage.

[2] Refers to 1968-69, latest data available.

Source: Prepared in the Farm Production Economics Division Economic Research Division, U.S. Department of Agriculture.

Private Outdoor Recreation Farms

Public demand for outdoor recreation is far in excess of the existing and projected supply of public facilities. The public sector is not flexible enough to supply the specialized types of recreation or services demanded by smaller groups. The privately-owned outdoor recreation enterprise, particularly the farm-base type, is in a unique position to supply these types of recreation services and activities to the public.

The 1969 Census of Agriculture reported over 2.7 million farms in the United States. Of this total, about 30,400 earned money from some type of recreation activity.

Many farm operators in the vicinity of national, State, and local parks, or near wildlife preserves have taken advantage of their location in establishing recreation businesses. The average amount received from this activity was about $1,630 per farm reporting.

These farmers sell hunting or fishing rights to individuals, form hunting clubs, or establish private campgrounds. They absorb the overflow from public campgrounds or cater to the individuals who want more privacy in their camping. Vacation farms cater to family groups during the summer and allow hunting later in the year when children are in school. Many farmers enlarge and improve their ponds or irrigation reservoirs. They stock ponds for fishing and have swimming areas in the summer and skating in the winter. Old farm buildings, sheds, and barns are converted into riding stables or horse boarding stables, or a combination of both. Shore and backwater areas are used to dock privately owned craft. In making such facilities available, many farmers have converted a liability into an asset. Farmers become guides for hunters during the game season and mechanics and service engineers for watercraft. Guides are also in demand for nature trails and scenic tours.

Other Specialties

Other highly specialized operations, such as fur farms, apiaries, greenhouses, nurseries, and flower farms, require special knowledge and skilled management. Special skills and equipment are required, and risks are high. Even with the high risk, from the standpoint of capital invested and income, the venture is often rewarding to individuals who have the ability and the resources to engage in it.

Sources of Additional Information

Additional information may be obtained from the U.S. Department of Agriculture, Washington, D.C. 20250; the Department of Commerce, Washington, D.C. 20230; and from Colleges of Agriculture.

AGRICULTURE-RELATED PROFESSIONAL WORKERS

Nature of the Work

The discussion that follows deals primarily with job categories that are generally termed professional fields. These occupations generally require at least a bachelor's degree, and master's and Ph.D. degrees are becoming increasingly valuable both from the standpoint of salary level and of performing the functions required on the job. Some of these jobs are discussed more fully elsewhere in the *Handbook*. (See index.)

Agricultural economists (D.O.T. 050.088) deal with problems related to production, financing, pricing, and marketing of farm products both in the United States and in several foreign countries. These economists are factfinders, evaluators, analysts, and interpreters who provide economic information to farmers, policymakers, and other interested persons. They provide cost-benefit analyses for evaluating farm programs at the National, State, and farm level. They study the effects of mechanization, technological advances, and other developments that influence the supply and demand for farm products and the accompanying effects on costs and prices of farm products.

Agricultural engineers (D.O.T. 013.081) develop new and improved farm machines and equipment, deal with the physical aspects of soil and water problems in farming; design and supervise installation of irrigation systems, watershed protection, flood prevention, and related works; devise new techniques for harvesting and processing farm products; and design more efficient farm buildings.

Agronomists (D.O.T. 040.081) are concerned with growing, breeding, and improving field crops such as cereals and grains, legumes and grasses, tobacco, cotton, and others. They do research also in the fundamental principles of plant sciences and study and develop seed propagation and plant adaption.

Animal physiologists and *animal husbandmen* (D.O.T. 040.081) study and do research in the environmental influences in relation to efficient management of farm animals; they are concerned also with the breeding, growth, nutrition and physiology of livestock.

Veterinarians (D.O.T. 073.081) inspect livestock at public stockyards and points of entry into the United

States; inspect establishments that produce veterinary biological supplies; administer tests for animal diseases; conduct programs for the control and eradication of animal disease; research livestock diseases and vaccines for disease control; work directly with farmers in protection or restoration of livestock health; and provide services for the care of small animals and pets. (See statement on veterinarians elsewhere in the *Handbook* for additional information.)

Geneticists (D.O.T. 041.081) try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited than those presently available for the production of food and fiber.

Microbiologists (D.O.T. 041.081) study bacteria and the relation of other micro-organisms to human, plant, and animal health and the function of these micro-organisms in the making of products such as vitamins, antibiotics, amino acids, sugars, and polymers.

Plant scientists (D.O.T. 041.081) study plant diseases and their nature, cause, and methods of control. They also study the structure of plants and the growth-related factors in plants. Methods of improving fruits, vegetables, flowers, and ornamentals, and means by which improvements may be made by better management, environment, and propagation are also of major concern.

Plant quarantine and *plant pest control inspectors* (D.O.T. 041.081) who are trained in the biological sciences, supervise and perform professional and scientific work in enforcing plant quarantine and pest control laws. Plant Quarantine Inspectors inspect ships, planes, trucks, and autos coming into the country to keep out dangerous insect pests. Plant Pest Control Inspectors conduct programs to protect the crops of the country by prompt detection, control, and eradication of plant pests.

Entomologists (D.O.T. 041.081) study insects, both beneficial and harmful to farming. They are concerned particularly with identifying the populations and distributions of insects that injure growing crops and animals; that harm human beings; and that damage agricultural commodities during shipping, storage, processing, and distribution. These concerns are involved particularly toward finding means by which these insects may be controlled.

Foresters (D.O.T. 040.081) are concerned with the protection, production, processing, and distribution of our timber resources. They also study means by which wood may be seasoned, preserved, and given new properties.

Human nutritionists (D.O.T. 077.128) study the means by which the human body utilizes food substances.

Rural sociologists (D.O.T. 054.088) study the structure and functions of the social institutions (customs, practices, and laws) that are a part of rural society and/or affect it.

School teachers (D.O.T. 091.228) in vocational agriculture and related fields supervise and give instructions in farm management, communications, mechanics, engineering, and related fields.

Farm managers, including agriculture management specialists, supervise and coordinate the production, marketing, and purchasing and credit activities of one farm or a group of farms.

Places of Employment

Persons trained in these specialties work in various capacities that relate to agriculture. Government agencies, colleges, agricultural experiment stations, and private businesses that deal with farmers hire many research workers. They also hire people to take technical and administrative responsibilities in public agencies involving farmers or programs affecting farmers. Agribusinesses, farmer cooperatives, private business, commercial, and financial companies that buy from, sell to, or serve farmers also employ many professionals with agriculture related training. State, county, and municipalities hire many who serve as vocational agriculture teachers and workers in agricultural communications, in farmers' organizations, or in trade associations whose members deal with farmers.

The number of research activities related to agriculture has increased very rapidly. The largest agencies in this field are the State agricultural experiment stations connected with the land-grant colleges and the various research branches of the U.S. Department of Agriculture. Such agricultural specialists work for other research organizations in independent research, and in companies that finance farming operations, market farm products, or produce chemicals, equipment, and other supplies or services for farmers. The U.S. Department of Agriculture employs workers in research positions in various parts of the country: in Washington, D.C.; at the Agricultural Research Center at Beltsville, Md.; and at land-grant colleges. Other Government departments also have many agricultural research jobs.

Various independent research organizations, foundations, and private business groups in many parts of the country recently have initiated research related to agriculture. They tend to be located either in industrial centers or in areas of high agricultural activity, and include producers of feed, seed, fertilizer, and farm equipment; and of insecticides, herbicides, and other chemical dusts

and sprays.

Public and private lending institutions, which make loans to farmers, employ men with broad training in agriculture, and business. These workers ordinarily are required to have had practical farm experience, as well as academic training in agriculture, economics, and other subjects. Making financially sound loans involves careful analysis of the farm business and proper evaluation of farm real estate and other farm property. These workers are employed by the cooperative Farm Credit Administration in its banks and in associations operating under its supervision throughout the country; by the Farmers Home Administration in its Washington, State, and county offices throughout the country; by rural banks; and by insurance companies that have substantial investments in farm mortgages.

The Federal and State Governments also employ various specialists in activities relating to agriculture. These specialists have technical and managerial responsibilities in activities such as programs relating to the production, processing, marketing, inspection, and grading of farm products; prevention and spread of plant pests, animal parasites, and diseases; and management and control of wildlife.

Large numbers of professionally trained persons are employed by cooperatives (businesses owned and run by the farmers) and business firms that deal with farmers. Employment in these organizations may be expected to expand, as farmers rely increasingly on them to provide farm supplies, machinery, equipment, and services, and to market farm products. The size of the organization and the types of services it offers determine the number of its employees and the nature of their jobs. Large farm supply cooperatives and businesses, for example, may have separate divisions for feed, seed, fertilizer, petroleum, chemicals, farm machinery, public relations, and credit, each supervised by a department head. In smaller businesses and cooperatives, such as local grain-marketing elevators, the business is run almost entirely by the general manager who has only two or three helpers.

Agricultural communications is another expanding area of specialization. Crop reporters and market news reporters are employed by the U.S. Department of Agriculture in field offices throughout the United States. Crop reporters gather information on crop production during all stages of the growing season. Market news reporters collect information on the movement of agricultural produce from the farm to the market. Radio and TV farm directors are employed by many radio and TV stations to report prices, sales, grades, and other agricultural information to farm residents. Agricultural reporters and editors compile farm news and data for farm journals, bulletins, and broadcasts.

The nationwide, federally aided program of vocational education offers employment for persons technically trained in agriculture and related subjects. Teachers of vocational agriculture not only teach high school students interested in farming, but provide organized instruction to assist young farmers in becoming satisfactorily established in farming and in becoming community leaders. They also provide organized instruction for adult farmers, giving individual consultation at their farms to keep them abreast of modern farm technology.

The qualifications of workers in all of these fields ordinarily include a college education and special training in a particular line of work. In most of these fields, the demand for workers exceeds the supply. In recent years, the demand has been increased because of the need to recruit professional personnel to staff agricultural missions to other countries and to give technical aid to agricultural institutions and farmers there.

Sources of Additional Information

Opportunities in Research. Additional information at land-grant colleges may be obtained from the dean of agriculture at the State land-grant college. Information on employment in the U.S. Department of Agriculture is available from the USDA recruitment representatives at land-grant colleges and from the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

The following publications will be valuable:

Profiles-Careers in the U.S. Department of Agriculture U.S. Department of Agriculture, October 1968. Superintendent of Documents, Washington, D.C. 20402. Price $3.25.

Careers in Agriculture and Natural Resources—Agriculture American Association of Land-Grant Colleges and State Universities, Washington, D.C. 1966. Copies can be obtained free from State Agricultural Colleges.

Opportunities in Agricultural Finance. Inquiries on employment opportunities in agricultural finance may be directed to the following:

Farm Credit Administration, Washington, D.C. 20578.

Farm Credit District—Springfield, Mass.; Baltimore, Md.; Columbia, S.C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Nebr.; Wichita, Kans.; Houston, Tex.; Berkeley, Calif.; Spokane, Wash.

Farmers Home Administration, U.S. Department of Agriculture, Washington, D.C. 20250.

Agricultural Director, American Bankers Association, 90 Park Ave., New York, N.Y. 10016.

Opportunities with Cooperatives. About 22,000 cooperatives serve rural people in every area of the United States. These include marketing and farm supply cooperatives, rural electric telephone associations, rural credit unions, farm credit cooperatives, mutual irrigation and insurance associations, and artificial breeding associations.

They range from small local cooperatives serving one area to the large regional cooperatives made up of local cooperatives and their farmer members in several States. The locals usually have their headquarters in small towns, the regionals in larger towns or cities. Some regionals hire from 3,000 to 4,000 employees.

Cooperatives in the individual communities are a good source of information on jobs either in their own organizations or in other cooperatives. Most States have a State council or association of cooperatives that can provide information on cooperative locations and some job information.

The Cooperative Foundation, 59 East Van Buren Street, Chicago, Ill., 60605, has a publication, *Careers in Cooperatives*. It describes about 100 different kinds of jobs available in these businesses.

Among the several hundred thousand jobs these cooperatives provide are included:

—Management positions—jobs ranging from managing small local grain elevators to managing cooperatives that do several hundred million dollars worth of business a year.

—Marketing positions—jobs ranging from responsibility for harvesting, transporting, assembling, grading, storing, and selling raw products to processing, packaging, selling, and distributing farm products to retail outlets.

—Farm supply positions—jobs ranging from those in petroleum refineries, and feed mills, or fertilizer manufacturing plants, to those working on the floor of a supply center.

—Farm service positions—jobs such as those of field men who advise farmers on soil, seeds, and fertilizer usage, and who do soil testing; bulk feed deliverymen, machine operators who deliver supplies direct to farms, spread fertilizer on the field, or haul products to market for the farmer.

—Personnel administration positions—jobs such as those interviewers, position classifiers, counselors, and placement specialists.

—Research positions—jobs covering product development, product testing, quality evaluation of products, and economics research.

—Transportation—jobs such as physical distribution specialists, truck drivers, garage mechanics, traffic managers.

—Office positions—jobs such as secretaries, typist, clerks, receptionists.

Requirements for the jobs vary widely. Some demand college or graduate degrees, others high school education. Still others require no formal educational background, but do require basic skills such as those for writing up an invoice or handling a forklift truck in a warehouse.

Opportunities for Agricultural Economists. For additional information about opportunities in agricultural economics, check with the Department of Agricultural Economics at State land-grant colleges. For information on Federal employment opportunities, applicants may get in touch with USDA recruitment representatives at the State land-grant college or write directly to the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

Opportunities as Vocational Agriculture Teachers. As salaries, travel, and programs of vocational agriculture teachers vary slightly among States, prospective teachers should consult the Head Teacher Trainer in Agriculture Education at the land-grant college or the State Supervisor of Agricultural Education at the State Department of Public Instruction in their respective States.

FARM SERVICE JOBS

In almost every type of agriculture, farmers require specialized services which can be learned and performed readily by other workers.

A person can enter many of these services, either as an independent operator or as an employee. Some services require an extensive outlay of capital, and others require very little. Some are highly seasonal; others are performed year round. These services and the operation of a small farm can sometimes be combined.

Services that provide year-round employment include the following: Cow testing, artificial breeding, livestock trucking, whitewashing, well drilling, fencing, and tilling.

MINING AND PETROLEUM INDUSTRY

The mining and petroleum industry provides most of the basic raw materials and energy sources for industrial and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining yield many of the basic materials such as limestone and gravel for schools, offices, homes, and highways. Nearly all of our energy for industrial and personal use come from oil, gas, and coal. Few products from mines reach the consumer in their own natural state; nearly all require further processing.

The mining and petroleum industry employed about 607,000 wage and salary workers in 1972. About four-tenths of these worked in the exploration and extraction of crude petroleum and natural gas. Coal mining accounted for almost one-fourth of the industry's workers, and quarrying and nonmetallic mineral mining nearly one-fifth. The remaining workers were in metal mining.

As shown in the accompanying tabulation, nearly seven-tenths of all workers in the industry hold blue-collar jobs, primarily as operatives. Included in the operative group are oil well drillers, mining machinery operators, and truck and tractor drivers.

Skilled craftsmen and foremen constitute the second largest occupational group. Mechanics and repairmen maintain the complex equipment and machinery used in mining and oil well drilling. Many heavy equipment operators, such as power shovel and grader operators, work in open pit mining. Large numbers of pumpers, gagers, and enginemen hold jobs in the extraction and transportation of petroleum and natural gas. Foremen also constitute an important part of the industry's work force.

The industry's white-collar employees are divided nearly equally among three occupational groups—professional and technical, clerical, and managerial workers. Taken together, these groups compose the remaining three-tenths of the industry's employment. Professional, technical, and kindred workers are concentrated largely in petroleum and gas extraction. Most are engineers, geologists, or technicians engaged in exploration and research. Two out of three clerical employees work in petroleum and gas extraction. Most are secretaries, office machine operators, and typists.

Major occupational group	*Estimated employment, 1972 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	12
Managers, officials, and proprietors	7
Clerical and kindred workers	10
Sales workers	(1)
Craftsmen, foremen, and kindred workers	27
Operatives and kindred workers[2]	39
Service workers	1
Laborers	4

[1] Less than .5 percent.
[2] Includes mine laborers.

NOTE: Because of rounding, sums of individual items may not equal total.

Employment in the mining and petroleum industry is expected to decline slowly through the mid-1980's, despite increases in output. Increased demand for mining products will be met largely through improved equipment operated by a highly skilled work force. Even though employment as a whole is expected to decline, different growth patterns are likely within the industry. Employment in metal mining and petroleum and natural gas extraction is expected to decline. Quarrying and nonmetallic mining, on the other hand, are expected to increase.

The statements that follow provide information on employment opportunities in the petroleum and natural gas extraction industry and the coal mining industry. More detailed information about occupations in the mining and petroleum industries appears elsewhere in the *Handbook*.

COAL MINING

Nature of the Industry

When most people think of coal they usually think of it in an old pot-bellied stove heating a one room schoolhouse, small home, or country store. But today, coal is used for many purposes. Coal is an important ingredient in steel, chemicals, cosmetics and for the all important electric power.

Coal is usually divided into two major classes, bituminous and anthracite. Bituminous, or "soft" coal is the most widely used and the most plentiful, and accounts for most coal production. Production of anthracite, or "hard" coal, on the other hand, is steadily declining due to dwindling reserves. Other forms of coal, such as lignite and peat, are classified in the subbituminous category, and are used in limited amounts.

Most of the Nation's coal is mined in the Appalachian area which extends from Pennsylvania through Eastern Ohio, West Virginia, Virginia, Kentucky, Tennessee, and Alabama. A large amount of coal also is produced in Indiana, Illinois, and in the Rocky Mountain States.

Types of Mines

Coal is either mined underground or dug from the earth's surface. Underground mines produce about half of the bituminous coal and employ most of the miners. Surface mines account for the remaining coal, but employ only a small proportion of the industry's workers.

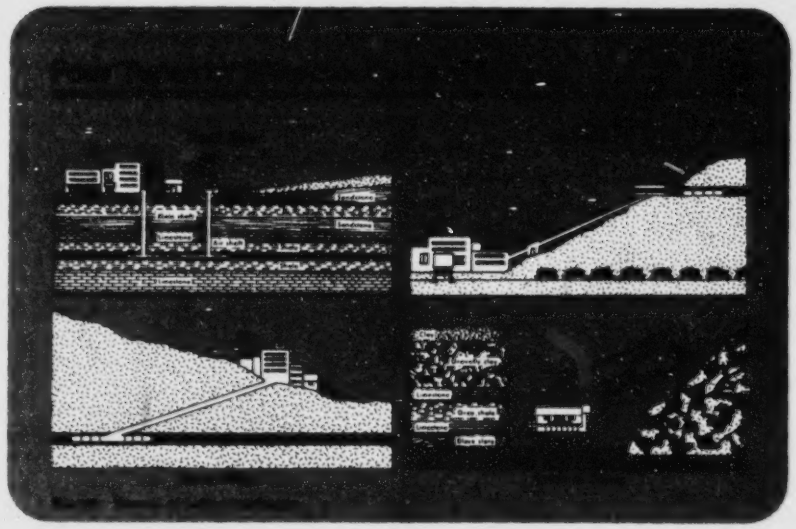
The type of mine a company decides to build depends on the depth and location of the coal seam. Underground mines are used to reach coal that lies deep below the surface. An entry tunnel must be dug so that miners and equipment can reach the seam and coal can be carried out. Depending on the depth of the coal seam, the entry may be vertical (shaft mine), horizontal (drift mine), or at an angle (slope mine). (See chart 20). Shaft mines are used to reach coal lying far below the surface. Drift and slope mines are usually not as far underground as shaft mines.

After the coal seam has been reached, nearly all underground mines are constructed the same way. Miners make a network of interconnecting tunnels so that the mine resembles a maze with passageways going off in all directions, sometimes stretching over many miles. As coal is removed, the tunnels become longer and longer. A significant amount of coal is left between the tunnels to support the roof. When miners reach the end of the company's property, they start working back toward the entrance. Some of the remaining coal is dug and the roof is then caved in as they retreat.

If the coal seam is not too far below ground, a surface mine is used. Two types of surface mines are strip and auger. At strip mines, huge machines tear the earth away and dig out the coal. Auger mining is used to remove coal from hillsides. A large auger (drill) bores into the hill and pulls the coal out.

Occupations in the Industry

In 1972 about 145,000 people worked in the coal mining industry. About 85 percent were the production workers who mined and processed coal. Different types of mining jobs range from helpers who load coal with a shovel, to experienced miners who operate equipment worth several hundred thousand dollars. Jobs available in a mine, however,



vary by type and method of mining.

Mining Occupations. Two basic methods of mining underground coal, conventional and continuous, account for 96 percent of total underground production. A third method, longwall, makes up the remaining.

Conventional mining is the oldest method and requires the most workers and procedures. In conventional mining, a long strip is first cut beneath the coal seam to control the direction of falling coal when it has been blasted. The cutting is done by the *cutting machine operator* (D.O.T. 930.883), who runs a huge, electric chain saw, with a cutter ranging in length from 9 to 15 feet. Next the *drilling machine operator* (D.O.T. 930.782) drills holes into the coal where the *shot firer* (D.O.T. 931.782) places explosives. After the blast the *loading machine operator* (D.O.T. 932.883) scoops up and dumps the coal into small railroad cars, which are run by the *shuttle car operator* (D.O.T. 932.883). These cars take the coal to a conveyor belt where the *conveyor man* (D.O.T. 630.381) controls the movement of coal to the main entry or to the surface.

The continuous mining method eliminates the drilling and blasting operations of conventional mining. The *continuous-mining machine operator* (D.O.T. 930.883) runs a machine that cuts or rips out the coal and loads it onto a conveyor or shuttle cars.

Longwall mining is basically an extension of continuous mining. In this method one machine, run by the *longwall machine operator* digs and loads coal and at the same time reinforces the roof.

Many other workers are required to run a safe and efficient underground mine. A foreman, called a *face boss* (D.O.T. 939.138) supervises all operations at the work site

Miner at controls of continuous mining machine.

where coal is actually mined. Before miners are allowed to enter, the *fire boss* (D.O.T. 939.387) inspects the work area for dangerous gases and adequate ventilation. Coal dust is extremely explosive, and interferes with breathing. The *rock-dust machine operator* (D.O.T. 939.887) sprays limestone on the mine walls and ground to hold down the dust.

Roof falls always pose a serious threat in a mine, so the work of the *roof bolter* (D.O.T. 930.883) is extremely important. This worker operates a machine to install roof-support bolts. The *brattice man* (D.O.T. 869.884) constructs doors, walls or partitions in the passageways to force air through the tunnels to working areas.

Most surface miners operate the large machines that remove the earth above the coal, and dig and load the coal. In a strip mine the overburden is first drilled and blasted. Then the *overburden stripping operator* or *dragline operator* (D.O.T. 859.883) scoops the earth away to expose the coal. Next the *coal loading machine operator* (D.O.T. 932.833) loads the coal onto trucks to be driven to the preparation plant. In auger mines, the *auger operator* (D.O.T. 930.782) runs the machine that pulls the coal from sides of hills. *Tractor operators* (D.O.T. 929.883) drive bulldozers to move materials or pull out imbedded boulders or other objects. Helpers assist in operating these machines.

Skilled repairmen, called *fitters* (D.O.T. 801.281) fix all types of mining machinery, and electricians check and install electrical wiring. Carpenters construct and maintain benches, bins, and the wooden bodies of mine cars. Helpers may be stationed in any work area to aid experienced miners and to learn the trade. Many mechanics and electricians assemble, maintain, and repair the machines used in mines. Truck drivers haul the coal to preparation plants.

Preparation Plant Occupations. Rocks and other impurities must be removed before coal is crushed, sized or blended, to meet the buyer's wishes. These processes take place at the preparation plant.

Many preparation plants are located next to the mine. The plant's size and number of employees vary by the amount of coal processed and degree of mechanization. Some plants have all controls centrally located and require only one worker to oversee all washing, separating and crushing operations. This worker is known as a *preparation plant central control operator* (D.O.T. 549.138). At each step other plants

that are not as mechanized need workers such as the *wash box attendant* (D.O.T. 541.782) and *separation tender* (D.O.T. 934.885). Wash box attendants operate equipment to size coal and separate impurities from it. Using currents of water, the separation tender operates a device that further cleans coal.

Administrative, Professional, Clerical and Technical Occupations. The coal industry employs a wide range of administrative, professional, technical and clerical workers. At the top of the administrative group executives make all policy decisions. Decision making requires a staff of specialists such as accountants, attorneys, and market researchers.

Clerical and secretarial workers assist the administrative staff. They may keep records on personnel, payroll, sales, production and other paper work.

Although most of our coal seams have been discovered, they must still be examined for purity and depth. The type of mine to be built also must be determined. This work generally is done by the *mining engineer* (D.O.T. 010.081 and .187) who is involved in all aspects of building and maintaining a safe mine. *Surveyors* (D.O.T. 018.188) also may be called in to help map out the mining area.

Many other types of engineering and scientific personnel also are employed. Mechanical engineers oversee the installation of equipment, such as centralized heat and water systems. Safety engineers attempt to prevent or correct hazardous conditions in the mines. Involved in research such as converting coal into a gas or a liquid are physicists, chemists, and geologists.

Training, Other Qualifications, and Advancement

Most young people start out as helpers to experienced workers and learn mining skills on the job. Some companies supplement on-the-job training with formal programs, but training varies from company to company. For example, some companies have training mines where skills are taught; others give classroom instruction for a few weeks before allowing workers into a mine.

Many courses also are available on health and safety procedures, mining techniques, and mining machinery. The U.S. Bureau of the Mines, coal companies, and the United Mine Workers of America conduct classes on health, safety and mining methods. Mine machinery manufacturers offer courses in machine operation and maintenance.

As miners gain more experience they can move to higher-paying jobs. When a vacancy occurs, an announcement is posted and all workers who believe they are qualified may bid for the job. A mining machine operator's helper, for example, may become an operator. The position is filled on the basis of seniority and ability to do the work. A small number of miners advance to supervisory positions and, in some cases, to administrative jobs in the office.

Miners must be at least 18 years old and in good physical condition. A high school diploma is not required. All miners should be able to work in close areas and have quick reflexes in cases of emergencies.

Rock dusting machine operator sprays powdered limestone to control coal dust.

Scientists and engineers should have at least a Bachelor's Degree. Requirements for administrative and clerical jobs are similar to those in other industries. College graduates are preferred for jobs in advertising, personnel, accounting, and sales. For clerical and secretarial jobs, employers usually hire high school graduates who have training in areas such as stenography and typing.

Employment Outlook

As the Nation's demand for electric power grows, more coal will be mined to fuel electric power plants. More coal also will be needed to make steel, chemicals, and other products, or for conversion into fuel oil or natural gas. Most job openings, however, will arise as experienced miners retire, die, or transfer to other fields of work. Retirements and deaths alone are expected to create several thousand openings each year through the mid-1980's.

Earnings and Working Conditions

Union wage rates for miners in late 1972 ranged from $4.80 an hour to $5.75 an hour. In comparison, production workers in manufacturing averaged $3.81 an hour. On the average, workers in underground mines earn slightly more than those in surface mines or preparation plants.

Because underground miners spend much time traveling from the mine entrance to their working areas, they have a slightly longer working day than surface workers. Those in surface occupations work a 7-1/4 hour day (36-1/2 hour week), while underground miners work in 8-hour day (40 hour week).

Many mines operate around the clock so some miners work on afternoon or night shifts for slightly higher wages.

Most miners receive 9 holidays and 14 days of paid vacation each year. As their length of service increases, they gain extra vacation days up to a total of 24. Union workers also receive benefits from a welfare and retirement fund, and workers suffering from pneumoconiosis (black lung) receive federal aid.

Miners have unusual and harsh working conditions. Underground mines are damp, dark, noisy and cold. At times, several inches of water may be on tunnel floors. Although mines have electric lights, many areas are illuminated only by the lights on the miners' caps. Workers in mines with very low roofs have to work on their knees, backs, or stomachs in cramped areas.

Though safety conditions have improved considerably, miners must constantly be on guard for hazards. There is also the risk of developing pneumoconiosis (black lung) from coal dust and silicosis from the rock dust generated by the drilling in the mines. Surface mines and preparation plants are less hazardous than underground mines.

Sources of Additional Information

For details about job opportunities in mining contact individual coal companies. General information on mining occupations can be obtained from:

United Mine Workers of America, 900 15th St. NW., Washington, D.C. 20005.

Bituminous Coal Operator's Association, 918 16th St. NW., Washington, D.C. 20006.

OCCUPATIONS IN PETROLEUM AND NATURAL GAS PRODUCTION AND GAS PROCESSING

Nature and Location of the Industry

Petroleum is one of the fuels formed by the decay of living matter. It is extracted mainly in the form of crude oil and natural gas. This chapter deals with workers who are employed in the United States to find oil and gas and bring them to the earth's surface and to convert gas to usable products. In 1972, about 260,000 workers were engaged in these activities. Occupations in oil refining are discussed in a separate chapter elsewhere in the *Handbook*.

Crude oil and natural gas production covers three broad fields of work: exploration, drilling, and operation and maintenance of wells. Firms that specialize in these activities under contract to oil companies employ almost one-half of all workers in petroleum production. Major oil companies employ most of the remainder. Gas processing involves removing water, sulfur compounds and other impurities from natural gas, and separating liquid gases such as ethane and propane.

Since oil and gas are difficult to find, exploration and drilling are key activities in the petroleum industry. After scientific studies indicate the possible presence of oil, the company selects a well site and installs a towerlike steel rig to support the drilling equipment. A hole is bored deeper and deeper into the earth until oil is struck or the company decides to write the effort off as a loss. Although a few large oil companies do their own drilling, more than 95 percent is done by contractors.

When oil or gas is discovered, pipes, valves and other equipment are installed to control the flow of these raw materials from the well. There were more than 600,000 wells in this country in 1972, and about half of all the petroleum industry's production workers were needed to operate and maintain them.

Oil and gas are transported to refineries by pipeline, ship, barge, or truck. Many refineries are thousands of miles from oil fields, but gas processing plants usually are near the fields so that liquid compounds can be removed before the gas is piped to customers. These liquids—chiefly ethane, propane, butane, and natural gasoline—are important raw materials for refineries and chemical plants. Some are widely used as heating fuels in rural areas.

Although drilling for oil and gas is done in about three-fourths of the States, about 90 percent of the industry's workers are employed in 10 States. Texas leads in the number of oilfield jobs, followed by Louisiana, California, Oklahoma, Kansas, New Mexico, Wyoming, Mississippi, Colorado, and Illinois. Thousands of additional Americans employed by oil companies work in foreign countries, particularly the Middle East, Africa, Western Europe, South America, and Indonesia.

Occupations in the Industry

Workers with a wide range of education and skills are needed to drill, operate, and maintain wells and to process natural gas.

Production geologist studies core sample at well site.

Exploration. Exploring for oil is the first step in petroleum production. Small crews of specialized workers travel to remote areas to search for geological formations likely to contain oil. Exploration parties, led by a *petroleum geologist* (D.O.T. 024.081), study the surface and subsurface of the earth. Geologists seek clues to the possibility of oil traps by examining types of rock formations on and under the earth's surface. Besides making detailed ground surveys, petroleum geologists depend on aerial exploration and magnetic surveys for a broad picture of the area. Subsurface evidence is collected by boring and bringing up core samples of the rocks, clay, and sands that form the layers of the earth. From these examinations geologists draw cross-section maps of the underground formations to pinpoint areas where oil or gas may be located. In offshore exploration, they also may obtain rock samples from the bottom of the sea in their search for clues to oil-bearing formations.

Many geologists work in district offices of oil companies or exploration firms where they prepare and study geological maps. They also study samples from test drilling to find any clues to oil.

In addition to the petroleum geologist, exploration parties may include other geology specialists: *Paleontologists* (D.O.T. 024.081) study fossil remains in the earth to locate oil-bearing sands; *mineralogists* (D.O.T. 024.081) study physical and chemical properties of mineral and rock samples; *stratigraphers* (D.O.T. 024.081) determine the rock layers most likely to contain oil and natural gas; *photogeologists* (D.O.T. 024.081) examine and interpret aerial photographs of land surfaces; and *petrologists* (D.O.T. 024.081) investigate the history of the formation of the earth's crust. Exploration parties may also include *draftsmen* (D.O.T. 010.281) and *surveyors* (D.O.T. 018.188), who assist in surveying and mapping operations.

Most geophysical exploration is done by seismic prospecting. The seismograph is a sensitive instrument that records natural and man-made earthquakes. Artificial earthquakes in petroleum exploration are made by detonating explosives in the ground. The time it takes for sound waves to reach an underground rock layer and return indicates the depth of the layer. By setting off explosions at a number of locations, scientists can map underground formations with considerable accuracy, thus providing a clue to the whereabouts of traps that may contain oil.

A *geophysicist* (D.O.T. 024.081) usually leads a seismograph crew that may include *prospecting computers* (D.O.T. 010.288), who perform the calculations and prepare maps from the information recorded by the seismograph; *observers* (D.O.T. 010.168) who operate and maintain electronic seismic equipment; *shothole drillers* (D.O.T. 930.782) and their *helpers* (D.O.T. 930.886), who operate portable drilling rigs to make holes into which explosives are placed; and *shooters* (D.O.T. 931.381) who place and detonate explosives.

Before geophysical exploration the oil company must obtain permission to use the land. The *landman* or *leaseman* (D.O.T. 191.118) makes the necessary business arrangements with landowners or with owners of mineral rights.

Drilling. Exploration methods are used to find likely oil fields but only drilling can prove the presence of oil. Overall planning and supervision of drilling usually are the responsibilities of the petroleum engineer.

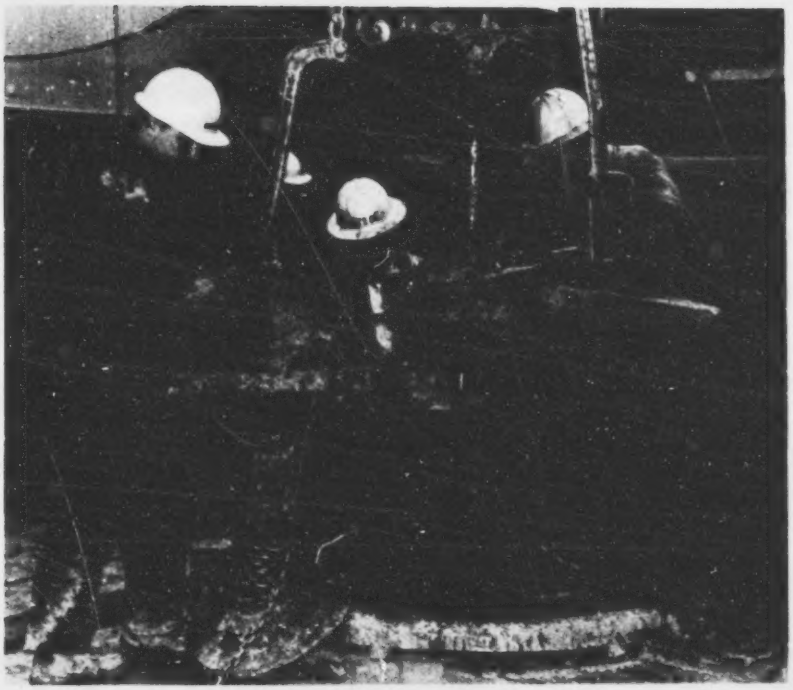
Wells are almost always started in the same way. *Rig builders* (D.O.T. 869.884) and a crew of *helpers* (D.O.T. 869.887) install a portable drilling rig to support the machinery and equipment that raises and lowers the drilling tools.

In one method called rotary drilling, a revolving steel bit bores a hole in the ground by chipping and cutting rock. Most drilling is done by the rotary method. The bit is attached to a length of pipe (drill stem) which is rotated by a diesel engine or an electric motor. As the bit cuts through the earth, the drill stem is lengthened by more pipe screwed on at the upper end. A stream of mud is continuously pumped into the hollow pipe and comes out through holes in the drill bit. This mud, a mixture of clay, chemicals, and water, cools the drill bit, plasters the walls of the hole to prevent cave-ins, and carries the cuttings to the surface.

A typical rotary drilling crew consists of a driller and three to five helpers. Divided into three crews, 15 to 20 workers generally operate a rig 24 hours a day, 7 days a week. A *rotary driller* (D.O.T. 930.782) operates machinery that controls speed and pressure, selects the proper drill bit, and records operations. The driller must be prepared to meet emergencies such as a breakdown of equipment or a fire.

A *derrickman* (D.O.T. 930.782), who is second in charge, works on a small platform high on the rig to help run a pipe in and out of the well opening. The derrickman also operates pumps that circulate mud through the pipe.

Other members of the drilling crew include *rotary helpers* (D.O.T. 930.884), also known as roughnecks, who guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and drill bits. An *engineman* (D.O.T. 950.782) may be added to



Rotary drill crew lowers section of drill pipe.

operate the engines that provide power for drilling and hoisting.

The *tool pusher* or *chiefdriller* (D.O.T. 930.130) is the foreman of one or more drilling rigs and supplies materials and equipment to rig builders and crews. *Roustabouts* (D.O.T. 869.884) or general laborers, though not considered part of a drilling crew, do general oil field maintenance and construction work. They clean tanks, build roads, and help welders and other craftsmen.

Well operation and maintenance. When oil is found, the drill pipe and bit are pulled from the well, and casing is lowered and cemented in place. The upper ends of the tubing and casing are fastened to a system of valves called a "Christmas tree." Pressure in the well forces crude oil and gas to the surface, through the Christmas tree, and into gas traps and storage tanks. If natural pressure is not great enough to force the oil to the surface, pumps are used.

Petroleum production engineers generally plan and supervise well operation and maintenance. To prevent waste, they decide the rate of oil flow and anticipate performance of oil reservoirs by analyzing information such as pressure readings from the wells. Engineers are increasingly using computers for analytical work. Some engineers specialize in overcoming effects of corrosion on well casings, in the selection and design of production equipment and processes, or in the prevention of pollution. Some companies hire engineer aides to make tests, keep records, post maps, and otherwise assist engineers.

Pumpers (D.O.T. 914.782) and their helpers operate and maintain motors, pumps, and other equipment to force oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer and production foreman. Generally, a pumper operates a group of wells. *Switchers* work in fields where oil flows under natural pressure and does not require pumping. They open and close valves to regulate the oil flow from wells to tanks or into pipelines, and *gaugers* (D.O.T. 914.381) measure and record the flow and take samples to check quality. *Treaters* (D.O.T. 541.782) test the oil for water and sediment and remove these impurities by opening a drain at the tank's base or by using special chemical or electrical equipment. In some fields, pumping, switching, gaging, and treating operations are automatic.

Many skilled workers are employed in maintenance operations. Welders, pipefitters, electricians, and machinists repair and install pumps, gages, pipes, and other equipment.

Natural gas processing. Most processing workers control equipment. The *dehydration-plant operator* (D.O.T. 541.782) tends an automatically controlled treating unit which removes water and other impurities from natural gas. The *gasoline-plant operator* (D.O.T. 914.132), operates compressors that raise the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.782) assists either of the two employees named above.

Many workers in the larger natural gas processing plants are employed in maintenance activities. The instrument repairman and the electrician are two key workers needed to maintain the instruments that control automatic equipment. Welders and their helpers also do much maintenance work in the processing plant. Other maintenance workers include engine repairmen, roustabouts, helpers, or laborers.

In numerous smaller natural gas plants, workers combine skills, usually of operator and maintenance man. Many small plants are so highly automated they are virtually unattended. They are checked by maintenance workers or operators at periodic intervals, or they are checked continuously by instruments which automatically report problems and shut down the plant if an emergency develops.

Other oilfield services. Companies that offer services on a contract basis provide another important source of employment. Among these employees are skilled workers such as *cementers* (D.O.T. 930.281), who mix and pump cement into the space between steel casings and well walls to prevent cave-ins; *acidizers* (D.O.T. 930.782), who force acid into the bottom of the well to increase the flow of oil; *perforator operators* (D.O.T. 931.782), who use subsurface "guns" to pierce holes in drill pipes or casings to make passages for oil to flow through; *sample-taker operators* (D.O.T. 931.781), who take samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well pullers* (D.O.T. 930.883), who remove pipes, pumps, and other subsurface devices from wells for cleaning, repairing, or salvaging.

Offshore operations. Most exploration, drilling, and producing activities are on land but an increasing amount of this work is done offshore, particularly in the Gulf of Mexico off the coasts of Louisiana and Texas. Some additional offshore work is being done in the Pacific Ocean off California, Oregon, Washington, and Alaska and in many foreign locations such as the Persian Gulf, Bass Strait, and North Sea. Some wells have been drilled over 100 miles from shore and in water more than 1,000 feet deep. These offshore operations require the same type of drilling crews as are employed on land operations. In addition, offshore operations require radio operators, cooks, sailors, and pilots for work on drilling platforms, crewboats, barges, and helicopters.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum and natural gas production industry, but in other industries as well, are given elsewhere in the *Handbook* in the sections covering individual occupations.)

Training, Other Qualifications, and Advancement

Most workers in nonprofessional jobs with an exploration crew begin as helpers and advance into one of the specialized jobs. Their training may vary from several months to several years. New workers usually are hired in the field by the crew chief or by local company representatives. College students majoring in physical or earth sciences or in engineering often work part-time or summer with an exploration crew. They may work into a full-time job after graduation.

Members of drilling crews usually begin as roughnecks. As they acquire experience they may advance to more skilled jobs. For example, a worker may be hired as a roughneck, advance to derrickman and, after several years, become a driller. A driller can advance to the job of tool-pusher in charge of one or more drilling crews. Crew members usually are between the ages of 20 and 40, since the work requires heavy labor. Some companies, however, report that their best drillers are over 50 and even in their sixties, for this job requires good judgment and experience rather than physical labor.

Companies generally hire people who live near operating wells for well operation and maintenance jobs. They prefer applicants who have mechanical ability and a knowledge of oil-field processes. Because this type of work is less strenuous and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs. New workers may start as roustabouts and advance to jobs as switchers, gaugers, or pumpers. Training usually is acquired on the job; at least 2 years of experience are needed to become an all-round pumper.

For scientists, such as geologists and geophysicists, college training with at least a bachelor's degree is required. The preferred educational qualification for a petroleum engineer is a degree in engineering with specialization in courses on the petroleum industry. However, college graduates having degrees in chemical, mining, civil, or mechanical engineering, or in geology, geophysics, or other related sciences, often are hired for petroleum engineering jobs. Petroleum engineering aides include people with 2-year technical degrees as well as former roustabouts or pumpers who have been promoted.

Scientists and engineers usually start at junior levels, and after several years of experience can advance to managerial or administrative jobs. Scientists and engineers who have research ability, particularly those with advanced degrees, may transfer to research or consulting work.

Information on training, qualifications, and advancement in natural gas processing plants is similar to that for petroleum refining. A statement on petroleum refining can be found elsewhere in the *Handbook*.

Employment Outlook

Employment in petroleum and

natural gas production is expected to decline slowly through the mid-1980's. Nevertheless, many job openings will be available to replace experienced workers who retire, die, or leave their jobs for other reasons.

Employment may decline in most established oil fields in the United States because of diminished oil reserves in these fields. However, the need for additional resources to meet fuel shortages is likely to cause employment increases in some areas. More exploration and drilling, for example, is expected in Alaska, at some offshore locations, and in other remote and unexplored areas of the world. In workers who have electrical or mechanical training to maintain and repair its increasingly complex machinery.

Earnings and Working Conditions

In 1972 nonsupervisory employees in oil and gas extraction averaged $3.97 an hour. In comparison, the average for nonsupervisory workers in all industries, except farming, was $3.65 an hour.

Most oilfield employees work outdoors in all kinds of weather. Oilfields often are far from populated areas, sometimes in swamps or deserts. Increasingly, oilfield employees are involved in offshore operations. Drilling employees may expect to move from place to place since their work in a particular field may be completed in less than a year. Exploration field personnel may be required to move even more frequently. They may be away from home for weeks or months at a time and live in a trailer or tent. Well operation and maintenance workers often remain in the same location for long periods.

In offshore operations, earnings usually are higher than those in land operations. Except for drilling activity that is close to shore, workers' living quarters are on platforms held fast to the ocean bottom or on ships anchored nearby. In offshore operations many work 7 days, 12 hours a day, and then have 7 days off.

Most workers in natural gas processing plants do not have to travel. Their jobs require only moderate physical effort although some workers must climb stairs and ladders to considerable heights. Some employees in natural gas processing have unusual working conditions. They travel rough, unpaved terrain in all kinds of weather to check small, unattended automated plants in isolated locations. These maintenance jobs may be very satisfying to those who like working alone outdoors.

Sources of Additional Information

Further information about jobs in the petroleum industry may be available from the personnel offices of individual oil companies. Information on scientific and technical jobs may be obtained from:

American Association of Petroleum Geologists, P. O. Box 979, Tulsa, Okla. 74101.

Society of Petroleum Engineers of AIME, 6200 North Central Expressway, Dallas, Tex. 75206.

American Geological Institute, 2201 M St. NW., Washington, D.C. 20037.

CONSTRUCTION

The activities of the construction industry touch nearly every aspect of our daily lives. The houses and apartments in which we live; the factories, offices, and schools in which we work; and the roads on which we travel are examples of some of the products of this important industry. The industry includes not only new construction projects, but also additions, alterations, and repairs to existing structures.

In 1972, about 3.5 million people worked in the contract construction industry. An additional 1.3 million workers are estimated to be either self-employed—mostly owners of small building firms—or are State and local government employees who build and maintain our Nation's vast highway systems.

The contract construction industry is divided into three major segments. About half of the job holders work for electrical, air conditioning, plumbing, and other special trade contractors. Almost one-third work for the general building contractors that do most residential, commercial, and industrial construction. The remaining one-fifth build dams, bridges, roads, and similar heavy construction projects.

As illustrated in the accompanying tabulation, workers in blue-collar occupations make up 80 percent of the construction industry employment. Craftsmen and foremen alone account for 55 percent of the total employment in this industry—a much higher proportion than that of any other major industry. Most of these skilled workers hold jobs as carpenters, painters, plumbers and pipefitters, construction machinery operators, and bricklayers, or in one of the other construction trades. Laborers are the next largest occupational group and account for 17 percent of employment. They provide materials, scaffolding, and general assistance to the craftsmen at the worksite. Semiskilled workers (operatives and kindred workers), such as truck drivers, welders and apprentices, represent about 8 percent of the industry's work force. Managers, officials, and proprietors—mostly self-employed—account for about the same share of employment. Professional and technical workers make up about 4 percent of the work force. Engineers and engineering technicians, draftsmen, and surveyors account for most of the employment in this occupational group. Clerical workers, largely typists, secretaries, and office machine operators, constitute another 7 percent of the industry's employment.

Major occupational group	*Estimated employment 1972 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	4
Managers, officials, and proprietors	10
Clerical and kindred workers	7
Sales workers	(1)
Craftsmen, foremen, and kindred workers	55
Operatives and kindred workers	8
Service workers	(1)
Laborers	17

(1) Less than 0.5 percent.

NOTE: Due to rounding, sums of individual items may not add to total.

Construction industry employment is expected to rise rapidly through the mid-1980's, as population and income growth create a demand for more houses, schools, factories and other buildings. Likewise, the number of construction workers employed by State and local highway departments should increase as the country's highway systems expand. Because of laborsaving improvements in tools, materials, and work methods, however, employment will not grow as rapidly as construction activity.

Contract construction is the major source of employment for skilled craftsmen such as bricklayers, painters, and carpenters. For information on these and other construction crafts, see the chapter on Construction Occupations elsewhere in the *Handbook*. For information on occupations that are found in many other industries, see the index in the back of the book.

MANUFACTURING

Manufacturing is a key activity of our Nation's economy. The products of the manufacturing industries range in complexity from simple plastic toys to intricate electronic computers, and in size from miniature electronic components to gigantic aircraft carriers. Manufacturing involves many diverse processes. Workers process foods and chemicals, print books and newspapers, spin and weave textiles, make clothing and shoes, and produce the thousands of other products needed for our personal and national welfare.

About 18.9 million people worked in manufacturing—the largest of the major industries—in 1972. About three-fifths of all manufacturing employees worked in plants that produced durable goods, such as steel, machinery, automobiles, and household appliances. The rest worked in plants that produced food, clothing, chemicals, and other non-durable goods.

In 1972, nearly 5.4 million women worked in manufacturing, which accounted for more than one-fifth of all women workers. Women represent a large proportion of the production workers in some industries, particularly the apparel, textiles, tobacco, and leather products industries.

As illustrated in the accompanying table, blue-collar workers (craftsmen and foremen, operatives, and laborers) make up about two-thirds of manufacturing employment. Operatives and kindred workers alone account for over four-tenths of the work force; many of these are spinners and weavers, sewing machine operators, machine tool operators and welders, or operators of the specialized processing equipment used in the food, chemical, paper, and petroleum industries.

Craftsmen, foremen, and kindred workers make up the next largest group of workers and account for nearly one-fifth of employment in manufacturing. Many of these skilled workers install and maintain the wide assortment of machinery and equipment required in all factories. Others are employed in skilled production occupations. Machinists, for example, are especially important in the metalworking industries, as are skilled inspectors and assemblers. In the printing and publishing industries, compositors, typesetters, photoengravers, lithographers, and pressmen make up a large share of the work force.

White-collar workers (professional, managerial, clerical, and sales workers) account for nearly one-third of manufacturing employment. Clerical workers, such as secretaries and office machine operators, are the largest white-collar group. Clerical workers hold about 1 out of every 8 jobs in manufacturing.

Professional, technical, and kindred workers account for about 1 out of every 10 jobs in manufacturing. Engineers, scientists, and technicians represent a large share of the professional workers. These highly trained workers not only oversee and guide the production processes, but also carry out the extensive research and development activities needed in the aerospace, electronics, chemical, petroleum, and other industries.

Major occupational group	*Estimated employment 1972 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	9
Managers, officials, and proprietors	6
Clerical and kindred workers	12
Salesworkers	2
Craftsmen, foremen, and kindred workers	19
Operatives and kindred workers	44
Service workers	2
Laborers	5

NOTE: Because of rounding, sums of individual items may not add to total.

Population growth, rising personal income, and expanding business activity will create a substantial increase in the demand for manufactured products through the mid-1980's. Employment in manufacturing, however, is expected to increase at a slower pace than production. The application of modern technology to manufacturing processes will make possible substantial increases in production of goods without a corresponding increase in the work force. Although the average rate of employment growth will be slow, employment trends of individual industries will vary widely. In the rubber and miscellaneous plastics products and furniture and fixtures industries, employment should increase about one-third, far above the average increase. Employment in several other industries—including machinery, instruments, and stone, clay, and glass—should increase more rapidly than the average for all

manufacturing. On the other hand, employment in some manufacturing industries is expected to decline. Tobacco, food, and lumber and wood products all may decrease in employment through the mid-1980's.

The statements that follow provide information on employment opportunities in several of the manufacturing industries. More detailed information about occupations that are found in manufacturing as well as in many other industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

OCCUPATIONS IN AIRCRAFT, MISSILE, AND SPACECRAFT MANUFACTURING

Firms that manufacture and assemble aircraft, missiles, and spacecraft make up what is known as the "aerospace" industry. In 1972, more than three quarters of a million people worked in the industry: about 500,000 in manufacture and assembly of complete aircraft, aircraft engines, propellers, and auxiliary parts and equipment; 90,000, missiles and spacecraft; and 160,000 in companies that make electronic equipment and instruments for aircraft, missiles, and spacecraft. Thousands of workers in other industries produced parts, machinery, and equipment used in the manufacture of aerospace vehicles. Also, thousands of Federal workers were engaged in aerospace related work, since the Government is a major purchaser of the industry's products. They worked primarily in the National Aeronautics and Space Administration (NASA) and in the Department of Defense.

Aerospace jobs exist in almost every State. The largest concentration is in California. Other States with large numbers of aerospace jobs include New York, Washington, Connecticut, Texas, Florida, Ohio, Missouri, Pennsylvania, Massachusetts, Kansas, Alabama, Maryland, New Jersey, and Georgia.

Nature of the Industry

Although there are many kinds of aircraft, missiles, and spacecraft, they all have the same basic components: a frame to hold and support the rest of the vehicle, an engine to propel the vehicle, and a guidance and control system. Missiles and spacecraft reach into space at speeds many times that of sound, while aircraft fly in the earth's atmosphere at much slower speeds. Missiles are powered by either jet or rocket engines; spacecraft are rocket-powered only. Aircraft are powered by piston, jet, or rocket engines.

Types of aircraft vary from small personal or business planes that cost not much more than an automobile, to multi-million dollar jumbo transports and supersonic fighters. Most aircraft (in dollar value) are manufactured for military use; however, those made for commercial and private use have been increasing.

Missiles are chiefly for military use and generally carry destructive warheads. Some are capable of traveling only a few miles, such as those that support ground troops and defend against low flying aircraft. Others have intercontinental ranges of 7,000 miles or more. Some missiles are launched from land or underground; others from aircraft, submarines, or ships.

Most of the country's spacecraft are built for NASA and the Department of Defense to explore outerspace or to monitor conditions within the earth's atmosphere (for example, weather conditions). They carry instruments that record and transmit to earth stations scientific data. On manned flights, a cabin capsule carries the astronauts. Some spacecraft probe the space environment and then fall back to earth. Others may enter into earth orbit and become artificial satellites. Still others may orbit or land on the moon and on distant planets.

Major aircraft, missile and spacecraft firms contract with government or private business to produce an aerospace vehicle. As contractors, they are responsible for managing and coordinating the entire project. This involves much planning and decision making. The firm's engineering department prepares final design drawings and specifications for the product, which then go to the production department where planners work on the many details regarding machines, materials, and operations needed to manufacture the vehicle. Production includes designing and producing the tools and fixtures needed to produce thousands of parts and accessories that make up an aerospace vehicle. Parts and components must be inspected and tested many times before being assembled, and completed systems are examined for conformance to specifications. Before a finished vehicle is delivered, it is checked out by a team of mechanics, or flight-tested if it is an aircraft.

Aircraft, missile, and spacecraft manufacturers generally make many components of a craft and do final assembly work. However, because there are so many components that make up aircraft, missiles, and spacecraft, much of the work is subcontracted to outside firms. There are thousands of subcontractors involved in the production of parts that go into aerospace vehicles. Some subcontractors make parts or supplies such as bearings, rocket fuels, or special lubricants. Others produce subassemblies such as communication or guidance equipment, or jet engines. Some of the firms may even depend on other subcontractors to supply parts for their subassemblies.

Because of the complex and changing nature of aerospace technology, firms need workers with

many different job skills that vary according to their fields of work. Research and development laboratories employ mainly engineers, scientists, and supporting technicians and craftsmen. Production operations, on the other hand, require assemblers, inspectors, machinists, and other plant workers.

Major jobs in aerospace manufacturing are described under three main categories: professional and technical; administrative, clerical, and related occupations; and plant occupations. Many of these jobs are in other industries as well and are discussed in greater detail elsewhere in the *Handbook*.

Professional and Technical Occupations. Research and development (R&D) are vital to the aerospace industry. Efforts are being made to develop vehicles with greater speeds, ranges, and reliability. Engines with more power and new sources of rocket propulsion such as nuclear and electric energy are being investigated and may be available in the future. Metals and plastics are continually being explored for wider capabilities, as are electronic guidance and communication systems. The pace of discovery in aerospace technology is so rapid that much equipment becomes obsolete while still in an experimental stage or soon after being put into production.

Emphasis on R&D makes the aerospace industry an important source of jobs for technical personnel. In 1972, almost one-fourth of all employees were engineers, scientists, and technicians, a considerably higher proportion than in most other manufacturing industries.

Engineers, scientists, and technicians work together in developing designs for aircraft, missiles, and spacecraft. Before an engineering department can approve a design for production, it must conduct tests to determine whether various design possibilities meet the conditions under which the vehicle will be operating. A scale model is made from a preliminary design. It is tested in wind, temperature, and shock tunnels and in other testing areas that simulate actual flight conditions. The next step is to build a full-sized experimental model, or prototype, which is thoroughly tested in the air and on the ground. If the test results are satisfactory, production may begin. The design is modified many times during the course of development, and often after production has started.

Many kinds of engineers and scientists work in the aerospace industry. Electronic, electrical, aerospace, chemical, nuclear, mechanical, and industrial engineers are among the larger engineering classifications. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, and astronomers. Aerospace engineers and scientists work in a wide and varied range of applied fields such as materials and structures, energy and power systems, and space sciences.

Among the many types of workers assisting scientists and engineers are technicians such as draftsmen, mathematics aides, and engineering and science technicians who do technical work that otherwise might have to be done by scientists and engineers. Engineers and scientists also work with other technical personnel such as *production planners* (D.O.T. 012.188), who plan the layout of machinery, movement of materials, and sequence of operations for efficient manufacturing processes; and *technical illustrators* (D.O.T. 017.281), who help prepare manuals and other technical literature describing the operation and maintenance of aerospace products.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs generally are comparable to similar jobs in other industries, except that they are often filled by engineers, scientists, and other technical personnel. Personnel in these jobs include executives responsible for the direction and supervision of research and production, and officials in departments such as sales, purchasing, accounting, and industrial relations. The industry also employs many thousands of clerks, secretaries, stenographers, typists, tabulating machine and computer operators, and other office personnel.

Plant Occupations. About one-half of all workers in the aerospace industry have plant- or production-related jobs. Plant jobs can be classified in the following groups: Sheet-metal work; machining and tool fabrication; other metal-processing; assembly and installation; inspecting and testing; flight checkout; and materials handling, maintenance, and custodial.

Sheet-Metal Occupations. Following blueprints and other engineering information, *sheet-metal workers* (D.O.T. 804.281) shape complicated parts from sheets of thin metal by hand or machine methods. Hand methods include the shaping of parts by pounding them with mallets and by bending, cutting, and punching them with handtools. Machine methods involve the use of power hammers and presses, saws, tube benders, and drill presses.

Less skilled workers do the more routine metal-shaping work. Among these are workers who specialize in the use of a single machine and fabricate parts required in large numbers. Some of these workers are *punch press operators* (D.O.T. 615.782), *power hammer operators* (D.O.T. 617.782) and *power shear operators* (D.O.T. 615.782 and .885).

Sheet metal workers sometimes shape complicated parts using hand tools.

Machining and Tool Fabrication Occupations. Another important group of workers engaged in shaping and finishing metal parts with machine tools includes *machinists* (D.O.T. 600.280 and .281) and *machine tool operators* (D.O.T. 609.885). These workers represent a higher-than-average proportion of the work force in engine and propeller plants, which are basically metal-working establishments, than in plants assembling complete aerospace vehicles.

The most skilled machinists are the all-round or general machinists who lay out the work and set up and operate several types of machine tools. They perform highly varied, nonrepetitive machining operations, frequently in departments making experimental and prototype vehicles.

Machine tool operators produce metal parts in large volume. They generally operate a single type of machine tool such as a lathe, drill press, or milling machine. Skilled operators set up work on a machine and handle difficult and varied jobs. Less skilled operators do more repetitive work.

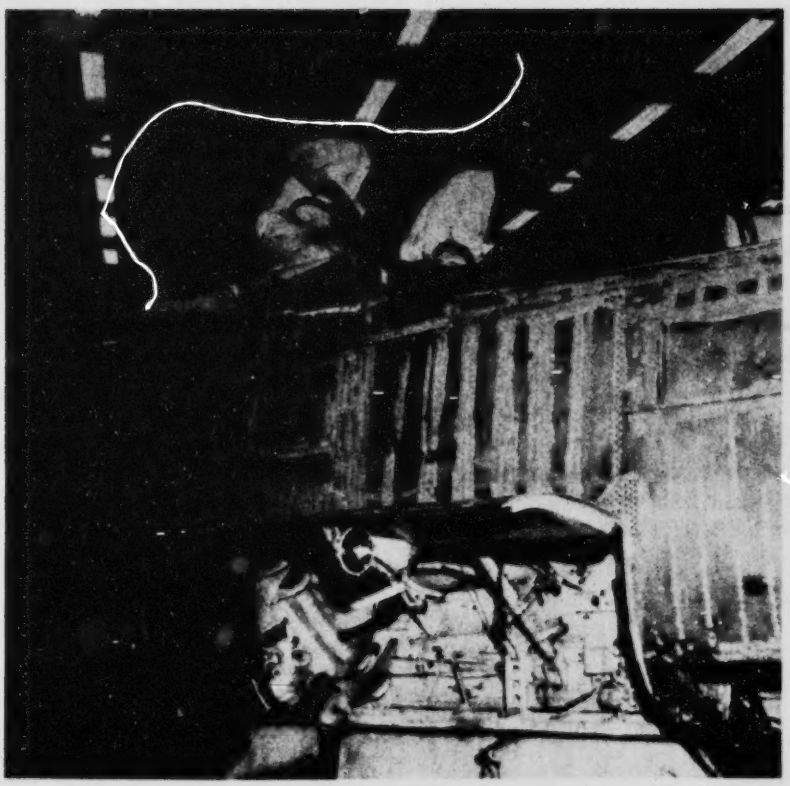
Skilled metal workers also produce jigs, fixtures, tools, and dies required for the production and assembly of parts for aerospace vehicles. On the basis of information received from an engineering department, *jig and fixture builders* (D.O.T. 693.280) plan the sequence of metal-machining operations for making a jig and carry the job through to completion. *Tool and die makers* (D.O.T.601.280) make the cutting tools and fixtures used in machine tool operations, and the dies used in forging and punch press work.

Other Metal-Processing Occupations. Some of the many other metal-working occupations include *tube benders* (D.O.T. 709.884), who form tubings used for oil, fuel, hydraulic, and electrical conduit lines; and *riveters* (D.O.T. 800.884) and *welders* (D.O.T. 810.782 and .884; 811.782 and .884; 812.884 and 813.380 and .885), who use mechanical and electrical devices to join fabricated parts. Metal-working jobs also are in foundry plants where workers produce castings by pouring molten metal into molds.

Many aircraft, missile, and spacecraft parts are chemically-treated and heat-treated during their manufacture to clean, change, or protect their surfaces or structural condition. For example, sheet-metal parts are heat-treated to keep the metal soft and malleable for metal-shaping work. The surfaces of parts often require many other treatments such as painting and plating. Workers in these metal-processing jobs have titles such as *heat treater* (D.O.T. 504.782), *painter* (D.O.T. 845.781), and *plater* (D.O.T. 500.380).

Assembly and Installation Occupations. Practically all plants in the aerospace industry employ assembly and installation workers. Some work in the assembly of engines, electronic equipment, and auxiliary components, but most assemble complete aircraft or spacecraft. They do final assembly work such as the fitting together of major subassemblies and installing major components. In an aircraft, for example, this work involves joining wings and tails to the fuselage and installing the engine and auxiliary equipment such as the fuel system and flight controls. Assemblers perform tasks such as riveting, drilling, bolting, and soldering.

A large proportion of assemblers are semiskilled and do repetitive work. However, many are skilled mechanics and installers who read blueprints and interpret other engineering specifications as they take apart, inspect, and install complex mechanical and electronic assemblies. Some, such as *final assemblers* of complete aircraft (D.O.T. 806.781) and *missile or rocket assembly mechanics* (D.O.T. 625.281), do general assembly work, and often work on experimental, prototype, or special craft. Other skilled assemblers work in plants that produce relatively large numbers of aircraft and missiles rather than a few experimental types. These assemblers often specialize in one field of



work; for example, *armament assemblers* (D.O.T. 801.381) specialize in installing weapons and related equipment in aircraft. Assemblers also specialize in other systems such as power plants, electrical wiring, heating and ventilation, and plumbing.

Inspecting and Testing Occupations. Because aircraft, missiles, and spacecraft are extremely complex and affect the life and safety of people, firms employ workers to conduct thousands of painstaking inspections and tests as each component and part moves through the production and assembly stages. The final product also is thoroughly tested before delivery. Inspections, which often involve the use of complex equipment, are made not only by employees of the manufacturers but also by employees of Federal agencies and commercial firms that have contracted for the equipment.

Inspectors generally specialize in a certain area of aerospace manufacturing. Among the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 806.381) who examine machined parts, subassemblies, and tools and dies ordered from other firms. They also serve as a "link" between their own engineering department and supplying companies. Among the inspectors in production are *machined parts inspectors* (D.O.T. 609.381) and *fabrication inspectors* (D.O.T. 807.381) who examine machined parts and fabricated sheet-metal respectively to see if they meet engineering specifications. As parts are fitted together, they are examined by *assembly inspectors* (D.O.T. 806.381), who usually inspect complete major assemblies and installations such as fuselage, wing, and nose sections to insure their proper fitting. They also check the functioning of hydraulic, plumbing, and other systems. Less skilled inspectors usually check subassemblies.

Flight Checkout Occupations. Checking-out every part of an aircraft or spacecraft before its first flight requires a team of mechanics having different levels and types of skills. The *crew chief* is the most skilled mechanic of the team, and directs other workers in the entire checking-out operation. Among the other workers in the team are *engine mechanics* specializing in checking out the powerplant of a craft, including the engine, propellers, and oil and fuel systems; and *electronics checkout* men who do the final operational checkout of radio, radar, automatic pilot, fire control, and electronic guidance, and other systems. Sometimes the checking-out process requires making minor repairs sometimes it involves returning the craft to the plant when it needs extensive repairs.

Materials Handling, Maintenance, and Custodial Occupations. Aerospace plants employ large numbers of materials handlers such as truck drivers, shipping clerks, and toolroom attendants. Maintenance workers who keep equipment and buildings in good operating condition and make changes in the layout of the plant, include maintenance mechanics, electricians, carpenters, and plumbers. Guards, firemen, and janitors make up a major portion of the plant's protective and custodial employees.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences usually is the

minimum requirement for working as an engineer or scientist in the aerospace industry. A few workers obtain these jobs without a college degree, but only after years of work experience and some college-level training. An undergraduate preparing for a career as an aerospace engineer or scientist should get as solid a background as possible in mathematics and physics. More specialized fields of the industry require graduate school education or on-the-job training.

An increasing number of technical occupations such as draftsmen and electronics technicians require two years of formal education in a technical institute or junior college. Others may qualify through several years of diversified work experience.

Plant jobs require many skill levels. Some less skilled jobs that require repetitive work can be filled by workers with little or no training and learned quickly on the job. On the other hand, more skilled jobs require some combination of job related experience, high school or vocational education, and on-the-job training. Many workers often start at trainee level positions and work their way up to the more skilled occupations.

Skilled assemblers often need 2 to 4 years of plant experience in addition to a high school or vocational school education. They must be able to read and interpret engineering blueprints, schematic diagrams, and production illustrations.

Skilled inspectors often have several years of machine shop experience. They must be able to install and use various kinds of testing equipment and instruments, read blueprints and other specifications, and use shop mathematics. New workers who have little or no experience in shop trades also may obtain training for less skilled inspecting jobs.

Mechanics who do final checkout of aircraft and spacecraft qualify for their job in several ways. Many gain experience working in earlier stages of the production line; others receive all their training in checkout work or as "line maintenance" mechanics with commercial airlines.

Chief mechanics usually need 3 to 5 years of experience in the manufacture of aircraft, missiles, and spacecraft, including at least 1 year as a checkout mechanic. Specialized mechanics, working under the supervision of a chief mechanic, usually need at least 2 years' experience. Less experienced helpers or assistants learn on the job through plant training courses.

Apprenticeship programs are sometimes available for craftsmen such as machinists, tool and die makers, sheet-metal workers, aircraft mechanics, or electricians. The programs vary in length from 3 to 5 years depending on the trade and during this time the apprentice handles work of progressively increasing difficulty. Besides on-the-job training, the apprentice receives classroom instruction in subjects related to the craft. Such instruction for a machinist apprentice, for example, includes courses in blueprint reading, mechanical drawing, shop mathematics, trade theory, physics, and other subjects.

Because complex and rapidly-changing products require highly trained workers, aerospace plants sometimes support formal training to supplement day-to-day experience and help workers advance more rapidly. Most are short-term programs to meet immediate needs. Some major producers conduct training classes or pay tuition and related costs for outside courses. Some classes are held during working hours; others may be after working hours. Training programs generally cover many skills and areas, for example, blueprint reading, drafting, welding, aircraft maintenance, and electronic data processing.

Employment Outlook

Employment in the aerospace industry is expected to rise above recent levels by the mid-1980's. The number of people working in this industry, however, probably will remain below the peak levels of the late 1960's.

Thousands of jobs will open each year because of the growth expected in the industry, and to replace workers who retire, die, and transfer to jobs in other industries. Job opportunities should be most favorable for highly-trained workers such as engineers and technicians. Some jobs will become available for skilled plant workers. However, employment of semiskilled and unskilled workers is expected to decrease, since many aerospace products are custom made.

A large proportion of aerospace products are primarily for national defense and to advance the Nation's goals in space. Therefore, the industry's future depends largely on the level of Federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment. For example, aerospace employment declined sharply from the high levels of the late 1960's partly because of decreased aircraft requirements for Vietnam and reduced expenditures for space exploration. The current outlook for this industry is based on the assumption that defense spending will be slightly below the levels of the late 1960's and R&D spending will be above current levels. If they should differ substantially, the outlook will be affected accordingly.

Growing demand for civilian aircraft products also is an important

element underlying the expected increase in aerospace employment. The increasing mobility of the population should encourage expanded use of large wide-bodied commercial aircraft and development of rapid air-taxi operations between major urban centers. Increased business flying, expanded use of helicopters for such tasks as medical evacuation and traffic reporting, and exports of aircraft to foreign nations are some of the other major factors influencing the growth of civilian aircraft manufacturing.

Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1972, for example, production workers in plants making aircraft and parts averaged $192 a week, or $4.60 an hour; production workers in all manufacturing industries as a whole averaged about $135 a week, or $3.60 an hour.

The following tabulation indicates an approximate range of hourly wages for selected occupations in 1972 obtained from the collective bargaining agreements of a number of major aerospace companies; these rates do not include incentive earnings. The ranges in various jobs are wide, partly because wages within an occupation vary according to workers' skills and experience, and partly because wages differ from plant to plant, depending upon type of plant, locality, and other factors.

Aircraft mechanics	$4.00–5.70
Assemblers	$3.25–5.00
Electronics technicians	$4.50–6.00
Heat treaters	$3.50–4.90
Inspectors and testers	$3.30–5.75
Jig and fixture builders	$4.60–5.80
Machinists	$3.70–5.70
Maintenance craftsmen	$3.70–5.80
Riveters	$3.50–4.20
Tool and die makers	$4.10–5.90
Welders	$3.50–5.25

Fringe benefits in the industry usually include 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 to 12 years. Employees generally get eight to twelve paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, dental, and hospital insurance; accident and sickness insurance; and retirement pensions.

Most employees work in modern factory buildings that are clean, well-lit and ventilated. Some work outdoors. Operations such as sheet-metal processing, riveting, and welding may be noisy, and some assemblers may work in cramped quarters. Aerospace plants, however, are relatively safe plants in which to work.

Most plant workers in the aerospace field are union members. They are represented by several unions including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America; and the International Union of Electrical, Radio, and Machine Workers. Some craftsmen, guards, and truck drivers are members of unions that represent their specific occupational groups.

Sources of Additional Information

Additional information about careers in the aerospace field is available from:

National Aeronautics and Space Administration, Washington, D.C. 20546.

Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

For specific information about an occupation contact:

International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical Radio, and Machine Workers, AFL-CIO, CLC 1126 16th St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE ALUMINUM INDUSTRY

Aluminum was once considered a specialty metal having limited applications. Today it is produced in quantities second only to iron and steel. It is used in products that range from household appliances and cooking utensils to automobiles, aircraft, and missiles. In recent years, many new uses for aluminum have been developed, including house siding, containers, and electrical cables. In 1972, the industry produced about 8.2 billion pounds of primary aluminum, or twice the output of only 10 years earlier.

This chapter describes occupations in plants that produce primary aluminum and aluminum alloys. It also describes occupations in plants that roll, draw, and extrude aluminum and aluminum-base alloys. Occupations concerned with casting, forging, stamping, machining, and fabricating of aluminum are discussed separately in the *Handbook* statements dealing with forge shop, foundry, and metalworking occupations.

The South Central area of the country, including Alabama, Arkansas, Louisiana, Tennessee, and Texas, leads in the production of primary aluminum, although the State of Washington is the Nation's largest producer. Plants within its borders represent about one-fifth of national primary aluminum capacity. The North Central area, consisting of Illinois, Indiana, Michigan, Ohio, and Kentucky, is the center for aluminum rolling, drawing, and extruding plants.

More than 95,000 persons worked in the aluminum industry in 1972. Employment was concentrated mainly in the rolling and extruding sector, although individual primary reduction plants in some cases employed more workers than rolling and extruding plants.

Occupations in the Industry

Employment in the aluminum industry falls into several categories. First, there is a wide assortment of jobs directly concerned with smelting (reduction) and transforming aluminum into industrial and consumer products. Workers in another group of occupations maintain and service the complex machinery and equipment used in the manufacturing process. These two large groups include about three-fourths of the industry's workers. The remaining one-fourth are in clerical, sales, professional, technical, administrative, and supervisory positions.

Women make up about 2 percent of the work force in primary aluminum plants and are mostly in secretarial and other clerical occupations. In rolling and drawing plants, however, women make up 10 percent of the work force, and are found in occupations such as sorter and inspector, as well as in clerical jobs.

Processing Occupations. The largest proportion of employees in the aluminum industry are in factory jobs processing the metal. To illustrate the types of processing occupations found in the industry, a description of the major steps in the production and fabricating of aluminum follows.

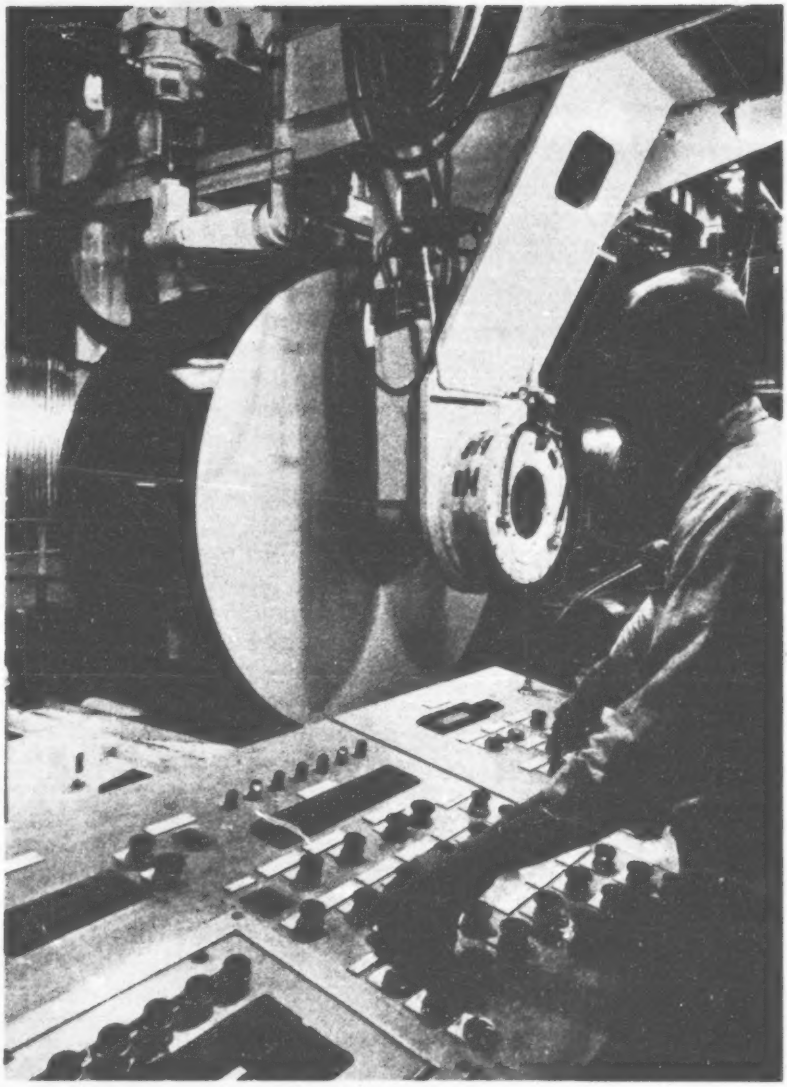
Reduction. Aluminum is obtained from alumina, a dry, fine white powder processed from bauxite ore. The alumina is made into a solution in deep rectangular steel cells or "pots" lined with carbon. The pots contain molten cryolite (sodium aluminum fluoride). Carbon blocks suspended in the solution or "bath" act as one pole (anode) and the carbon lining the pot as the other pole (cathode). Direct electrical current is sent through the solution, causing the alumina to change form (be reduced) to aluminum and accumulate in the bottom of the cell. Oxygen that has been driven from the alumina is converted to carbon dioxide.

Anode men (D.O.T. 630.884) maintain the anodes on the reduction cells. They pull pins from the anodes by means of hydraulic pullers, and clean scales from the pins using a sandblasting device. They may replace the pins using a steel driver.

Pot liners (D.O.T. 519.884) rebuild the anodes and reline the reduction furnaces when burned out. To line the pot, they loosen the sediment with water and dig out the material using jackhammers or diggers. Then they lay a brick base, drop carbon mix into the cell, line the walls and floor with carbon blocks, and finally tamp carbon paste into cracks using a pneumatic hammer.

Potmen (D.O.T. 512.885) see that the pots operate continuously. Each potman tends a number of different cells. During the operation of the pot, the alumina gradually is consumed. As the alumina content in the cells decreases, the potman breaks the crust of the "bath" and stirs in additional alumina.

Every 24 to 72 hours, molten aluminum is siphoned from the bottom of the reduction cells into huge cast-iron pots or "crucibles." The *tapper* (D.O.T. 514.884) and *tapper helper* (D.O.T. 514.887) signal the



Rolling mill operator oversees computerized cold rolling.

hot-metal crane operator (D.O.T. 921.883) to place the overhead crane near the pot. Using an automatic pot puncher, they break a hole in the crust. One end of a curved cast iron tube is inserted into the pot, the other into a crucible. After a compressed air hose is attached to the siphon, the molten metal is drawn into the crucible. After several tappings, an overhead crane moves the loaded crucible to a remelting or holding furnace.

A *scaleman* (D.O.T. 502.887) weighs and samples the molten metal for laboratory analysis and separates alloys to be blended with molten aluminum. Workers operating overhead cranes pour the molten metal in the crucible into a remelting furnace. A *remelt operator* (D.O.T. 512.885) adds portions of aluminum scrap, other molten metal, and alloys to obtain desired properties. Finally, a hand skimmer removes aluminum oxides forced to the surface of the molten metal by a fluxing compound.

The metal is then transferred to the second or holding compartment of the furnace until a sufficient supply is obtained for pouring. The *d.c. casting operator* (D.O.T. 514.782) has charge of the pouring station where the molten metal is cast into ingots—large blocks of metal. The operator controls the cooling conditions of the casting unit by maintaining a constant level of metal in the molds and operates a series of instruments that spray water against the molds to produce ingots of uniform quality.

Rolling and Finishing. Aluminum products such as plate, sheet, and strip are produced by rolling. The first step in rolling is to remove surface impurities from the ingot. The *scalper operator* (D.O.T. 605.782) manipulates levers of a scalper machine and cuts thin layers of metal from the ingots. Heat treating brings the ingots to proper working temperatures for rolling. Workers operating overhead cranes lower them into furnaces, or "soaking pits," where they are kept sealed for 12 to 18 hours. The *soaking pit operator* (D.O.T. 613.782) manages the furnace and controls the temperature and heating time.

The huge ingots are positioned on the "breakdown" or hot rolling mill where they are converted into elongated slabs. *Rolling mill operators* (D.O.T. 613.782) manipulate the ingots back and forth between powerful rollers until they are reduced in thickness to about 3 inches. The slabs then move down the line on the rollers to additional hot mills that work them down to a thickness of

about one-eighth of an inch. At the end of the hotline, a *coiler operator* (D.O.T. 613.885) tends a coiler that automatically winds the metal onto reels.

The coiled aluminum cools at room temperature before being cold rolled still thinner. Cold rolling produces a better surface finish and increases the metal's strength and hardness. Since continuous cold-rolling could make the metal too brittle, an *annealer* (D.O.T. 504.782) occasionally heat treats (anneals) the metal.

After annealing, the metal may be further cold rolled to a specified thickness and again heat treated to soften it for future fabrication. *Stretcher-leveler-operators* (D.O.T. 619.782) and *stretcher-leveler-operator helpers* (D.O.T. 619.886) then position the finished plate or sheet in a stationary vise, determine the stretch required to remove surface contours, and operate the machine that pulls the metal from end to end.

During both the production and fabricating processes, workers and machines inspect the metal to assure quality. *Radiographers* (D.O.T. 199.381) operate various types of X-ray equipment to inspect the metal. Computers monitor operations and automatically adjust metal temperature and mill speed.

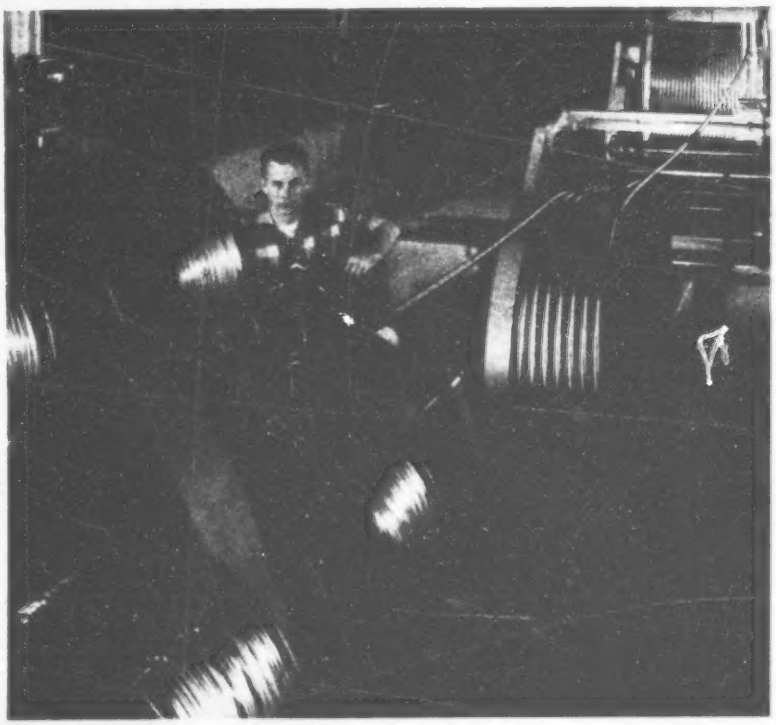
In the rod and bar mill, square castings called "blooms" are heated to make them softer and then rolled through progressively smaller openings, until the desired size is reached. To produce wire, hot rolling continues until the rod is about three-eighths of an inch in diameter. Then, *wire draw operators* (D.O.T. 614.782) operate machines that cold draw the wire through a series of dies that gradually reduce its diameter. The machine also automatically coils it on revolving reels.

Structural shapes such as I-beams and angles may be hot-rolled or extruded. Hot rolled structurals are made by passing a square bloom with rounded corners between grooved rolls that gradually reduce the thickness and change the shape of the metal.

Extrusion. Extruding of metal often is compared with squeezing toothpaste from a tube. Extruded aluminum shapes are produced by placing heated billets (bars) in an enclosed cylinder in a powerful press. A hydraulic ram that usually has a force of several million pounds pushes the metal through a die at the other end of the cylinder. The metal takes the contour of the die in cross-section and then may be cut into desired lengths. By designing different dies, almost any shape of aluminum product may be formed. An *extrusion press operator* (D.O.T. 614.782) regulates the rate at which the metal is forced through the press.

Maintenance, Transportation, and Plant Service Occupations. Large numbers of workers in the aluminum industry keep machines and equipment operating properly. Others move materials, supplies, and finished products throughout the plants; still others are in service occupations such as guard, policeman, and custodian. Many of these occupations are common to other industries. (See index to the *Handbook*.)

Since electricity is vital in the reduction process, the industry needs many electricians to install electrical fixtures, apparatus, and control equipment. Electronics mechanics repair computers, industrial controls, and other complex electronic gear.



Mill worker operates machine that makes aluminum cable.

Millwrights move, maintain, and repair mechanical equipment. Maintenance machinists make and repair mechanical parts for plant machinery. Stationary engineers operate and maintain the powerplants, turbines, steam engines, and motors used in aluminum plants.

Diemakers lay out, assemble, and repair dies used in aluminum metalworking operations. Bricklayers build, rebuild, and reline boilers, furnaces, soaking pits, and similar installations. Plumbers and pipefitters lay out, install, and maintain piping and piping systems for steam, water, and industrial materials used in aluminum manufacture. Maintenance welders join metal parts by hand or machine riveting and by resistance welding and electric arc and gas welding.

Professional, Technical, Administrative, and Clerical Occupations. Engineers, scientists, and technicians make up a significant proportion of the industry's workers in other types of activities.

Companies employ quality control chemists to analyze the aluminum and the raw materials used in its production. Process metallurgists determine the most efficient methods of producing aluminum from raw materials. Physical metallurgists test aluminum and aluminum alloys to determine their physical characteristics. They also develop new alloys and new uses for aluminum.

Chemical engineers and mechanical engineers design and supervise the construction and operation of reduction and fabricating facilities. Most mechanical engineers work in the fabricating sectors of the industry, where they may design, regulate, and improve rolling mills and related equipment. Electrical engineers plan and oversee the installation, operation, and maintenance of the electric generators and transmission and distribution systems used in the manufacture of aluminum. Industrial engineers conduct work measurement studies and develop management control systems to aid in financial planning and cost analysis.

Engineering technicians, laboratory technicians, and chemical analysts assist engineers and chemists in research and development work. Draftsmen prepare the working drawings that are required for the manufacture and repair of reduction and fabricating machinery.

A wide range of other professional and administrative workers are needed in the manufacture of aluminum. Top executives manage the companies and determine policy. Middleline managers and superintendents direct individual departments, offices, and operations. The industry also employs other administrative personnel and accountants, lawyers, statisticians, economists, and mathematicians. Clerical workers, including bookkeepers, secretaries, stenographers, clerk typists, and keypunch and computer operators keep company records and do other routine office work.

Training, Other Qualifications, and Advancement

Aluminum companies generally hire and train inexperienced workers for processing and maintenance jobs. A bachelor's degree is required for most professional jobs, and graduate degrees in science or engineering are preferred for research and development work. Administrative and managerial positions usually are filled by workers who have engineering or science backgrounds and have been promoted to these jobs. Some new graduates who have degrees in business administration or liberal arts may fill entry level administrative jobs. Sales positions often are filled by persons with technical backgrounds.

Applicants and current employees who demonstrate an aptitude for technical work have opportunities to qualify as technicians, laboratory assistants, and other semi-professionals. Some college background in engineering and science or graduation from a technical institute or community college is required for many technical jobs.

An unskilled worker begins his career in a labor pool and substitutes for absent workers until he becomes eligible for a permanent position in a shop or department. As these workers acquire additional skills and seniority with the company, they usually move to more responsible and better paying positions. Former production and maintenance workers fill many foreman and supervisory jobs.

Craftsmen usually are trained on the job. A number of companies, particularly the larger ones, have craftsmen apprenticeship programs that include classroom or home study courses, as well as on-the-job training. Generally, candidates for these programs are chosen from promising young workers already employed by the company. The length of the apprenticeship varies according to the craft, although most requires 3 to 4 years. Examples of crafts that can be learned through apprenticeship are: electrician, welder, brickmason, carpenter, machinist, maintenance mechanic, pipefitter, and general maintenance mechanic.

Employment Outlook

Employment in the industry is expected to rise moderately through the mid-1980's, although the amount of aluminum produced annually is likely to increase much more rapidly. Most job opportunities will stem

from the need to replace workers who retire, die, or leave the industry for other reasons.

Demand for aluminum is expected to continue to grow as population increases and consumers have more money to spend on products made from aluminum. Industries that represent major markets for aluminum are growing industries with potential for new product development. For example, aluminum is being used widely in the construction of large office and institutional buildings and for residential construction and remodeling. Furthermore, the aluminum industry supports a strong research and development program and an aggressive marketing program which should continue to develop new alloys, processes, and products. As a result, the number of engineers, scientists, and technical personnel is expected to increase as a proportion of total employment. On the other hand, larger cell and plant capacities and technological developments, such as continuous casting and computer controlled rolling operations, will limit employment growth among some production occupations.

Earnings and Working Conditions

Hourly earnings of plant workers in the aluminum industry are higher than the average for manufacturing industries. In 1972, production workers in primary aluminum plants averaged $4.95 an hour, and those in aluminum rolling and drawings plants averaged $4.44. In comparison, production workers in manufacturing industries as a whole averaged $3.81 an hour.

Skilled operators and skilled maintenance and craft workers hold the highest-paying plant jobs. Hourly rates in 1972 for selected occupations in a number of plants covered by one major union-management contract are shown below.

Occupation	*Hourly wage rate*
Reduction:	
Anode man	$ 4.16
Pot liner	4.61
Potman	4.46
Tapper	4.68
Scaleman	4.09
Fabricating:	
Scalper operator	4.68
Soaking pit operator	4.31
Hot mill operator, junior	4.61
Continuous mill operator	5.12
Annealer	4.31
Sheet stretcher-leveler operator	4.24
Inspector	4.31
Extrusion press operator	4.75
Maintenance:	
Boiler fireman	4.53
Bricklayer	5.12
Welder, pipefitter, millright	5.05
Electrician, machinist	5.27

Aluminum workers receive many fringe benefits, such as paid vacations and holidays, retirement benefits, life and health insurance, shift differentials, supplemental jury-duty pay, and supplemental unemployment benefits. Most workers receive paid vacations ranging from 1 to 4 weeks, depending on length of service. In addition, there are extended vacation plans that provide a 13-week vacation every 5 years.

Salaried personnel generally receive benefits comparable to those for hourly employees. Starting salaries are determined by the job being filled, the applicant's qualifications, comparable area and industry wage scales, and the structure of the hourly pay scale at the plant. Graduates of accredited colleges receive good starting salaries, and engineering graduates usually receive the highest offers.

The reduction of alumina to aluminum requires high temperatures. The potroom is often hot, dusty, and smoky. Working conditions in reduction plants have been improved as a result of fume control programs and other projects. The fabricating side of the industry offers more favorable work conditions though workers in certain jobs are subject to heat, noise, and other discomforts. Because aluminum reduction is a continuous operation, some workers have to work nights and weekends.

The industry stresses safe working conditions and conducts safety education programs. Reduction plants have had a consistently lower rate of injuries per manhour than plants that smelt and refine other primary nonferrous metals, such as copper and zinc. For example, in 1970 the injury-frequency rate in aluminum reduction plants was about one-third of the rate in copper smelting plants and less than half the average rate for all manufacturing. The rate in aluminum rolling and drawing plants, however, is about one-fourth higher than the average rate for all manufacturing.

Most process and maintenance workers in the aluminum industry belong to labor unions. In addition, labor organizations represent some office and technical personnel. The unions having the greatest number of members in the industry are United Steelworkers of America; Aluminum Workers International Union; and International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

Information on aluminum production and uses, as well as careers, may be obtained from:

The Aluminum Association, 750 Third Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE APPAREL INDUSTRY

The apparel industry is an important source of jobs for workers who have widely different skills and interests. Many of these jobs can be learned in a few weeks; others take several years.

Nature and Location of the Industry

About 1.3 million people were employed in the apparel industry in 1972. Approximately 585,000 produced women's and children's apparel and about 490,000 men's. The rest made various items including fur goods, gloves, hats, curtains, and draperies.

The apparel industry is the largest employer of women in manufacturing. Four out of five workers in the industry are women.

Although apparel factories are located in nearly all States, about 80 percent of the workers are employed in 15 States: New York, Pennsylvania, California, North Carolina, New Jersey, Georgia, Texas, Tennessee, Massachusetts, South Carolina, Alabama, Mississippi, Virginia, Missouri, and Illinois.

Some of the important Northeastern apparel manufacturing centers are in the New York City-Suburban New Jersey, Boston, and Philadelphia industrial areas, and in smaller cities in Pennsylvania such as Wilkes-Barre, Hazelton, and Allentown. Leading Midwestern and Western centers include Chicago, St. Louis, Dallas, El Paso, San Antonio, and Los Angeles. Apparel manufacturing in the Southeast tends to be widely dispersed. North Carolina, for example, has plants in about 80 of its 101 counties.

Most apparel plants are small. Only about 1 out of every 7 employs more than 100 workers. Plants that manufacture standard garments such as work pants usually are larger than those making expensive dresses and other items that are subject to rapid style change.

Occupations in the Industry

The major operations in making apparel are designing the garment, cutting the cloth, sewing the pieces together, and pressing. Generally, high grade and style-oriented apparel is more carefully designed and involves more handwork than cheaper, more standardized items. For example, much hand-detailing goes into a fashionable cocktail dress or a high-priced suit or coat, while apparel such as undershirts and overalls usually are sewn entirely by machine. To make the many different kinds of garments, workers with various skills and educational backgrounds are needed.

Designing Room Occupations: Typically, the manufacturing process begins with the *designer* (D.O.T. 142.081), who creates new types and styles of apparel. Inspiration for a new design may come from any of a variety of experiences: traveling, observing life styles, and seeing the work of other designers, to name but a few. In addition to creativity, designers must have practical knowledge of the apparel business so that they can translate their ideas into styles that can be produced at com-

petitive prices. They must, for example, be familiar with labor costs for various factory operations such as cutting, sewing, and pressing.

A large manufacturer generally has a head designer and several assistants. Many small firms, however, do not employ designers but purchase ready-made designs or patterns.

A designer usually works with one type of apparel, such as suits or dresses, although some work with several. For a high-quality dress, designers start by drawing sketches and choosing fabrics, trim, and colors. Using these sketches as guides, designers and their assistants make an experimental dress. They cut materials and pin, sew, and adjust the dress on a form or a live model until it matches the sketch.

Sample makers (D.O.T. 785.385) use this experimental dress as a guide in cutting and sewing fabrics to make a finished sample of the dress. After management has approved the sample, a *pattern maker* (D.O.T. 781.381) constructs a master pattern. Working closely with the designer, the pattern maker translates the sketch or sample dress into paper or fiberboard pieces, each one representing a part of the garment. A *pattern grader* (D.O.T. 781.381) measures the pieces that make up this master pattern, and modifies them to fit various sizes. Some large plants use computers to reduce the time needed to draw up the patterns for each size.

Styles for many items, such as men's suits and jackets, do not change significantly from year to year; thus, some of the steps described above are not required. A designer may alter the style of a suit, for example, by simply making minor changes on the master pattern. Before making such changes, however, the designer must be able to sketch or mentally picture how the

total appearance of the suit will be affected.

Cutting Room Occupations. Workers in the cutting room prepare cloth for sewing. There are five basic operations in the cutting department: spreading, marking, cutting, assembling, and ticketing. Small shops may combine two or more of these operations into a single job.

Hand spreaders (D.O.T. 781.887) lay out bolts of cloth into exact lengths on the cutting table. *Machine spreaders* (D.O.T. 781.884) are aided by machines in laying the cloth evenly across the table.

Markers (D.O.T. 781.484) trace the fiberboard pattern pieces on large sheets of paper, and may make several carbons of these tracings. In some cases they trace the pattern pieces with chalk directly on the cloth itself, rather than on paper. To get the greatest number of garments from a minimum quantity of cloth, markers arrange pattern pieces so that there is just enough distance between them for the cutter to work.

A *cutter* (D.O.T. 781.884) cuts out the various garment pieces from layers of cloth. Sometimes these layers are as high as 9 inches. The cutter follows the outline of the pattern on the cloth with an electrically powered knife which cuts through all the layers at once. The work of a cutter and a marker frequently is combined into a single job.

The pieces of cloth that have been cut are prepared for the sewing room by another group of specialized workers. *Assemblers*, sometimes called *bundlers* or *fitters* (D.O.T. 781.687), bring together and bundle the pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They match color, size, and fabric design and use chalk or thread to mark locations for pockets, buttonholes, buttons, and other trimmings. They identify each bundle with a ticket, which is also used to figure the earnings of workers who are paid according to the number of pieces they produce. The bundles are then routed to the various sections of the sewing room.

Cutter directs electrically powered knife through many layers of cloth.

Sewing Room Occupations: About 2 out of every 5 apparel workers are handsewers and sewing machine operators. Expensive garments and finishing touches on moderate-priced clothing may need much hand sewing. Most sewing, however, is done with machines.

Sewing machine operators (D.O.T. 787.782) use machines that are heavier and run faster than the ones found in the home. These workers generally specialize in a single operation such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Some make sections such as pockets, collars, or sleeves; others assemble and join these completed sections to the main parts of the garment.

Sewing machine operators generally are classified by type of machine they use, such as single-needle sewing machine operator or blindstitch machine operator, and by the type of work performed, such as collar stitcher or sleeve finisher.

Most hand sewing is done on better quality or highly-styled dresses, suits, and coats. *Hand sewers* (D.O.T. 782.884) use needle and thread to perform various operations ranging from simple sewing to complex stitching. Many hand sewers specialize in a single operation, such as lapel-basting or lining-stitching.

Instead of being sewn, parts such as collars and lapels may be "fused" together by heat and pressure. A *fusing machine operator* places the garment part on a loading platform of a fusing press which is adjusted to apply the precise amount of pressure and temperature needed for a permanent bond.

In a typical apparel plant, bundles of cut garment pieces move through the sewing department, where the garments take form as they pass through a series of sewing operations. Each operator performs one or two assigned tasks on each piece in the bundle and then passes the bundle to the next operator. Many plants employ *material handlers* (D.O.T. 929.887) often called floor boys or floor girls who move garment bundles from one sewing operation to another.

Sewing machine operator on special machine.

At various stages of the sewing operations, *inspectors* and *checkers* (D.O.T. 789.687) examine garments for proper workmanship. They mark defects, such as skipped stitches or bad seams, which are repaired before the garments are passed on to the next sewing operation. Inspectors sometimes make minor repairs. *Trimmers, hand* (D.O.T. 781.887), often called thread trimmers and cleaners, remove loose threads, basting stitches, and lint from garments. This is called "in-process inspection."

Tailoring Occupations. Tailors (D.O.T. 785.261 and.381) and *dressmakers* (D.O.T. 785.361) are skilled workers who do difficult kinds of hand and machine sewing. Most of them are employed in making expensive clothing that needs precise shaping and finishing. Although some tailors and dressmakers make complete garments, most specialize in a few operations such as collar setting and lapel padding.

Bushelmen (D.O.T. 785.281) are tailors who repair defects in finished garments rejected by the inspector. They alter parts that have not been sewn correctly, rearrange padding in coats and suits, and do other sewing necessary to correct defects.

Pressing Occupations. The shape and appearance of the finished garments depend, to a large extent, on the pressing that is done during and after sewing operations.

Pressers (D.O.T. 363.782, .884, and .885) use various types of steam pressing machines, and may work with manikins and body forms, or use hand irons to flatten seams and to shape parts and finished garments. There are two basic types of pressers—underpressers and finish pressers. Underpressers specialize on particular garment parts, such as collars, shoulders, seams, or pockets. Their duties vary from simple smoothing of cloth and flattening of seams to skillful shaping of garment parts. Finish pressers generally do final pressing and ironing at the end of the sewing operations.

Fur Shop Occupations. Because furs are expensive and difficult to work with, each operation in making a fur garment requires an experienced craftsman. Many of these workers have special skills not found in plants that make other types of apparel.

The most skilled craftsman in a fur garment plant is the cutter, who also may be the foreman. A *fur cutter* (D.O.T. 783.781) selects and matches enough fur skins to make a single garment, such as a coat or

jacket, and arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instructions given by the cutter, *fur machine operators* (D.O.T. 787.782) stitch these pelts together to make garment sections. A *fur nailer* (D.O.T. 783.884) wets the sewn garment sections, stretches them by hand, and nails them on a board so that they will cover the pattern. When the sections are dry, this worker removes the nails and trims the fur exactly along the outline of the pattern. The fur machine operator then finishes sewing the various sections to complete the garment. *Fur finishers* (D.O.T. 783.381) sew in the lining, tape edges, make pockets, and sew on buttons and loops.

Administrative, Sales, and Maintenance Occupations. Most administrative positions in an apparel plant are in the production department. Production managers are responsible for estimating production costs, scheduling the flow of work, hiring and training workers, controlling quality, and supervising the overall production activities of the plant. In some small apparel firms, the production manager also is a designer.

Industrial engineers advise management about the efficient use of machines, materials, and workers. (Further discussion of industrial engineers is included elsewhere in the *Handbook*.)

Clerks, bookkeepers, stenographers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork. In some large plants, many clerical functions are handled with computers. This requires keypunch operators, computer programmers and operators, and systems analysts. Salesmen, purchasing agents, models, accountants, and sewing machine mechanics are among other types of workers in the apparel industry. (Discussions of many of these jobs can be found elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Most production (plant) workers in the apparel industry pick up their skills on the job by helping and observing experienced workers. Training time ranges from a few weeks to several years, depending on the type of occupation, the worker's aptitude, and the employer's training programs. A relatively small number of employees are trained in formal apprenticeship programs for highly skilled occupations, such as cutter and tailor. Apprenticeships include both classroom and on-the-job training. Some private and public schools in apparel manufacturing centers offer courses in patternmaking, cutting, and tailoring, as well as machine and hand sewing. Students who complete these courses, however, usually need additional on-the-job training.

Many production occupations are well suited for the handicapped and the aged, because the work is done while the worker is seated. Little physical effort is required. Good eyesight and manual dexterity, however, usually are required.

Entry into beginning hand or machine-sewing jobs is relatively easy, since there are few restrictions regarding education and physical condition. New workers start by sewing straight seams, under the supervision of a skilled worker or foreman, and progress to more complicated sewing as they gain experience. Many large companies have special on-the-job training programs for sewing machine operators. The operator is taught how to perform each operation with minimal finger, arm, and body movement. The ability to do routine work rapidly is essential, since nearly all sewers are paid by the number of pieces they produce. Some sewers advance to other jobs in the plant, such as tailor or dressmaker; others become foremen. Most sewers, however, stay on the same general operation throughout their working lives and can look forward only to moving from simple sewing tasks to more complicated ones that pay higher piece rates.

New workers usually enter the cutting room by taking jobs as assemblers (bundlers or fitters). Patience and the ability to match colors are necessary for these jobs. An assembler may be promoted to spreader, and after a few years, to marker or cutter.

Pattern graders usually are selected from employees working in the cutting room or in other plant jobs. Training in drafting is helpful since much of the work requires the use of drafting tools and techniques.

Most patternmakers pick up the skills of the trade by working for several years as helpers to experienced patternmakers. Cutters and pattern graders are occasionally promoted to patternmaking. Patternmakers must be able to visualize from a sketch or model the size, shape, and number of pattern pieces required for a particular garment. They also must have a knowledge of fabrics, body proportions, and garment construction.

For beginning tailor and dressmaking jobs, many employers prefer to hire vocational school graduates who have had courses in these subjects. With a few years of additional apprenticeship or informal on-the-job training, graduates can qualify as skilled craftsmen. Some of these workers eventually become designers or supervisors. They can also transfer to jobs outside the apparel manufacturing industry as fitters and alteration tailors in clothing stores

and drycleaning shops.

Pressers usually begin as underpressers, working on simple seams and garment parts. Underpressing can be learned in a short time, and the worker can progress to the more difficult job of finish presser. These workers also can transfer to pressing jobs in drycleaning shops.

Many apparel firms prefer to recruit designers from colleges that offer specialized training in this field. Young graduates usually start as assistant designers. Some designers, however, have come up through the ranks by advancing from cutting, patternmaking, or tailoring jobs.

Designers should have a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. They should also acquaint themselves with garment making techniques by working briefly in various plant jobs, such as sample making, cutting, and machine sewing. Designers should know how to sketch.

A production manager usually begins as a management trainee, and an industrial engineer as a junior engineer. A college education increasingly is being required for these jobs. For those without college, many years of on-the-job training in all production processes, ranging from selection of fabrics to shipment of finished apparel, are required to qualify as a production manager.

Employment Outlook

Apparel industry employment is expected to grow slowly through the mid-1980's. Most job openings, however, will arise because of the need to replace workers who leave the industry. About 80 percent of the industry's employees are women, a large proportion of whom leave their jobs to marry or raise families. Also, a large number of the employees are near retirement age. Thousands of job openings each year are expected from retirements and deaths alone.

Demand for apparel in the years ahead is expected to increase as population and incomes continue to grow. The industry's greater emphasis on styling also may stimulate demand. Because of imported clothing, however, domestic production probably will not rise as fast as demand.

Employment in the industry is not expected to keep up with the production of apparel, because new mechanized equipment and improved methods of production and distribution are expected to result in greater output per worker. Examples of laborsaving equipment include sewing machines that can position needles and trim threads automatically; devices that automatically position fabric pieces under the needle and remove and stack completed pieces; and computer-controlled pattern making, grading, and cutting. Computers also are improving managerial control over sales, inventories, shipping, and production.

Despite technological advances in equipment, apparel manufacturing operations will continue to require much manual labor. Most employment opportunities will be for sewing machine operators, because this occupational group is the largest in the industry. Some job openings also will arise for pressers and designing and cutting room workers.

Opportunities will be numerous for engineers, fabric buyers, production managers, salesmen, and sewing machine mechanics. Young people who plan to become designers will face keen competition, because the number of people trying to get

Sewing machine operators in garment shop.

into this field exceeds the number of available jobs.

Earnings and Working Conditions

In 1972, production workers in the apparel industry averaged $2.61 an hour, compared with $3.81 an hour for those in all manufacturing industries. Production workers in the apparel industry worked fewer hours per week than those in manufacturing as a whole.

Average hourly earnings of production workers in 1972 varied among different kinds of apparel plants, ranging from $2.16 in plants that made men's and boys' workclothing to $3.26 in those that made men's and boys' suits and coats. Earnings of apparel workers also varied by occupation and geographical area. For example, average earnings of cutters and markers in almost all areas were higher than those of sewing machine operators; and earnings of all apparel workers generally were lower in the South than in the Northeast. The accompanying tabulation gives estimated average hourly earnings in 1971 for selected occupations and geographical areas in one segment of the apparel industry.

Because most production workers in the apparel industry are paid for the number of pieces they produce, their total earnings depend upon speed as well as skill.

Many apparel workers are union members, particularly those who work in metropolitan areas. The major unions in this industry are the International Ladies' Garment Workers' Union, the Amalgamated Clothing Workers of America, and the United Garment Workers of America. Some of these unions sponsor health care and child day care centers, cooperative housing, and vacation resorts for the benefit of their members.

Workers may be laid off for several weeks during slack seasons, particularly in plants that make seasonal garments, such as women's coats and suits. Employment is usually more stable in plants that produce standardized garments, such as pajamas and men's shirts, which are worn all year. In many plants, the available work during slack periods is divided so that all workers can be assured of at least some earnings.

While many plants are housed in old buildings, others are located in modern buildings that have ample work space, good lighting, and air conditioning.

Because most employees sit when they sew the work is not physically strenuous, but the pace is rapid and many tasks are monotonous. A sewer may occasionally pierce a finger with a needle, but serious accidents are rare.

Working conditions in cutting and designing rooms are pleasant. These rooms often are in a separate area of the plant, away from the hustle and bustle of the sewing and pressing operations. Designing and cutting jobs are more interesting and less monotonous than most other apparel jobs.

Women's and Misses dresses

	Estimated average hourly earnings		
	Los Angeles-Long Beach	*Dallas*	*New York City*
All production workers	$ 2.55	2.19	$ 3.79
Cutters and markers	4.19	3.04	5.23
Pressers, hand	2.67	1.92	7.12
Sewers, hand	2.14	2.03	3.22
Sewing machine operators, section system	2.33	2.22	3.45
Sewing machine operators, single hand (tailor) system	2.65	2.04	3.78

Sources of Additional Information

Information on vocational and high schools that offer training in designing, tailoring, and sewing may be obtained from the Division of Vocational Education of the Department of Education in each State capital.

Information on apprenticeships may be obtained from the Apprenticeship Council of the State Labor Department or the local offices of State employment services. Some local Employment Service offices give tests to determine aptitudes that are important for many apparel industry jobs.

General information on jobs in the industry may be obtained from the following sources:

Amalgamated Clothing Workers of America, 15 Union Square, New York, N.Y. 10003.

American Apparel Manufacturers Association, 1611 North Kent St., Arlington, Va. 22209.

Associated Fur Manufacturers, Inc., 101 West 30th St., New York, N.Y. 10001.

Clothing Manufacturers Association of U.S.A., 135 West 50th St., New York, N.Y. 10020.

National Outerwear and Sportswear Association, Inc., 347 Fifth Ave., New York, N.Y. 10016.

International Ladies' Garment Workers' Union, 1710 Broadway, New York, N.Y. 10019.

United Garment Workers of America, 31 Union Square, New York, N.Y. 10003.

International Association of Clothing Designers, 12 South 12th St., Philadelphia, Pa. 19107.

National Board of the Coat and Suit Industry, 450 Seventh Ave., New York, N.Y. 10001.

National Dress Manufacturers' Association, Inc., 570 Seventh Ave., New York, N.Y. 10018.

OCCUPATIONS IN THE ATOMIC ENERGY FIELD

Atomic energy is a source of heat and radiation that can be used for peaceful as well as military purposes. Although peaceful applications have been expanding more rapidly in recent years, they are still in the early stages of development, and continuing research and development programs will be needed during the next several decades to find new and more efficient ways of utilizing this energy.

In 1972, more than 235,000 people worked in atomic energy activities. Large numbers did research and development work. Others worked in industries that manufacture nuclear weapons and other defense materials, nuclear reactors, and nuclear fuels. Most atomic energy workers are scientists, engineers, technicians, and craftsmen.

Applications of Atomic Energy

One significant use of atomic energy is the production of commercial electricity by nuclear reactors. (See chart—.) Steam produced by reactors now generates electricity for several communities. These reactors have become competitive with systems that use fossil fuels (such as coal and oil), and approximately 160 nuclear facilities will be built by the mid-1980's. Dual-purpose nuclear power-desalting plants, which would provide at the same time both a new source of fresh water and electric power, are being studied.

Nuclear reactors also power submarines and surface vessels. By eliminating refueling, nuclear propulsion extends the range and mobility of our naval forces.

Although existing reactors already generate huge quantities of power from a small amount of uranium, more efficient reactors may be operational by the mid-1980's. Scientists have produced uncontrolled fusion in the hydrogen bomb, but have not yet produced a controlled fusion reaction on a relatively small scale.

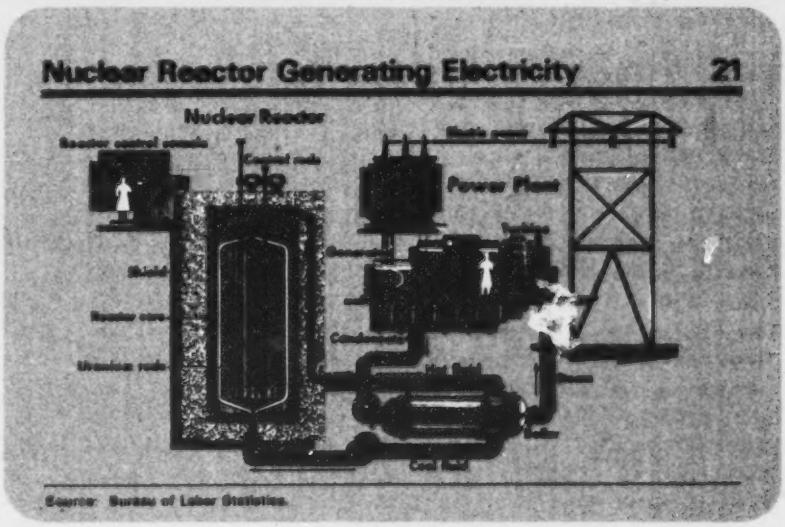
As part of the U.S. Atomic Energy Commission's (AEC) "Plowshare" program, research is underway to develop peaceful uses for nuclear explosives. The program has potential applications in areas such as gas and oil recovery, and the excavation of harbors, canals, and mountain passes.

Another significant application of atomic energy is in the use of radioisotopes which decay or disintegrate spontaneously. These radioisotopes emit radiation that special instruments, such as thickness gauges, can detect, and are valuable research tools in environmental studies, agriculture, medicine, and industry.

How Atomic Energy Is Produced

Although there are several processes for producing atomic or nuclear energy, the most common method used today is the fusion process. It involves splitting uranium or plutonium nucleus under neutron bombardment. When neutrons emitted from this fission process bombard other nuclei, further fission takes place and, under proper conditions, results in a "chain" reaction. This reaction releases energy which is converted into power. The detonation of an atomic bomb is an application of the explosive release of atomic energy. However, this energy must be controlled for commercial uses.

Controlled fission is the essential feature of a nuclear reactor. The re-



actor is like a furnace, and needs fuel to operate. The principal source material for reactor fuel is uranium 235. Uranium in its natural state contains less than 1 percent of readily fissionable material, uranium U-235. Although natural uranium is sometimes used as reactor fuel, a more concentrated and enriched fuel is produced and used by increasing the proportion of U-235 isotopes through a process called gaseous diffusion. The rate of fission and energy produced in a nuclear reactor usually is controlled by inserting special neutron-absorbing rods into the fuel chamber or "core."

When atomic energy is used commercially for power, the heat generated must be converted to electricity by conventional equipment. The major difference between nuclear and conventional thermal electric power stations is that the steam to drive turbines comes from a nuclear reactor rather than from a conventional one.

Fission releases nuclear radiation that ruins equipment and is dangerous to unprotected personnel. Therefore, special radiation resistant materials are used in reactors and caution is taken to protect personnel.

Nature of the Atomic Energy Field

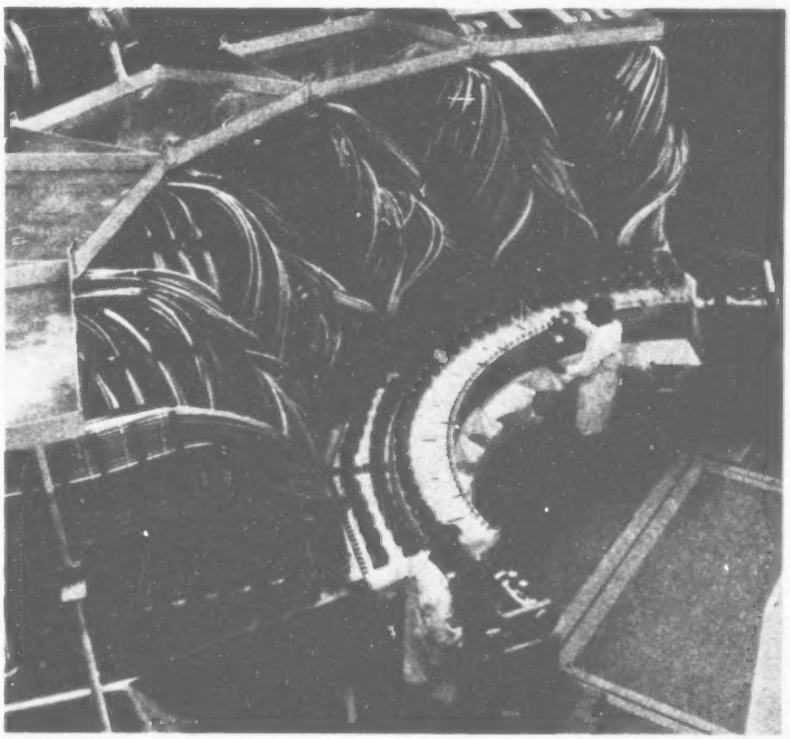
Many kinds of research and industrial activities are required for the production and use of nuclear energy. These processes include the mining, milling, and refining of uranium-bearing ores; the production of nuclear fuels; the manufacture of nuclear reactors, reactor components, and nuclear instruments; the production of special materials for use in reactors; the design, engineering, and construction of nuclear facilities, the operation and maintenance of nuclear reactors; the disposal of radioisotopes; the production of nuclear weapons; and research and development work.

These activities take place in plants, laboratories, and other facilities. Some work, such as mining and milling, manufacturing heat transfer equipment, and constructing facilities, differs little from similar work in other fields. Other activities, however, such as producing fuels needed to run reactors, are unique to the atomic energy field.

The Federal Government supports most of the basic atomic energy activities even though private support has been increasing. The U.S. Atomic Energy Commission directs the Federal Government's atomic energy program and regulates the use of nuclear materials by private organizations. The operation of AEC-owned facilities, including laboratories, uranium processing plants, nuclear reactors, and weapons manufacturing plants, is contracted to private organizations. More than half of all workers in the atomic energy field are employed in government-owned facilities. Privately owned facilities do all types of atomic energy work except for the development and production of military weapons and certain nuclear fuel-processing operations. A large amount of research and development work is carried out in AEC-owned laboratories, university and college laboratories, nonprofit institutions, and industrial organizations under AEC contracts.

Occupations in the Atomic Energy Field

Engineers, scientists, technicians, and craftsmen account for a higher



Scientists conduct experiments with thermonuclear research device.

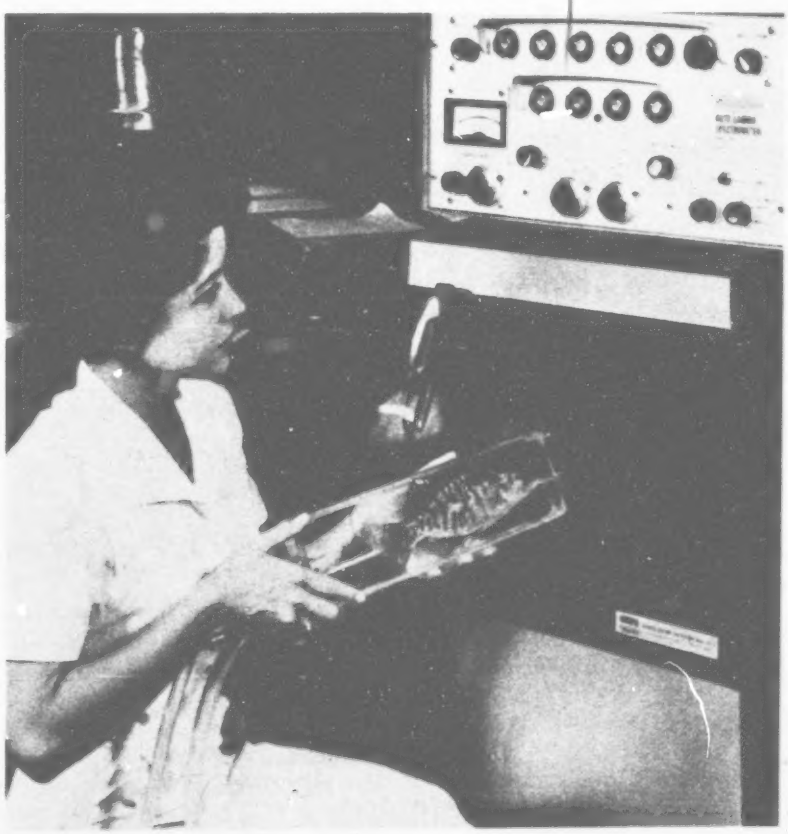
proportion of total employment in this field than in most others, mainly because much of the work is still in the research and development phase. Office personnel in administrative and clerical jobs represent another large group. Most of the remainder are semiskilled and unskilled workers involved in production operations, plant protection, and services.

Although many engineers working in the atomic energy field are trained in nuclear technology, engineers in all other fields are employed. Mechanical engineers are the largest single group but many electrical and electronic, chemical, civil, and metallurgical engineers also are employed. Many of these engineers do research and development work; others design nuclear reactors, nuclear instruments, and other equipment.

Research laboratories and other organizations that do atomic energy work employ scientists in basic and applied nuclear research. Most are physicists and chemists, but mathematicians, biological scientists, and metallurgists also do atomic energy research.

Large numbers of technicians assist engineers and scientists in research and development and in designing and testing equipment and materials. These workers include draftsmen, engineering and physical science technicians, and radiation monitors.

Many highly-skilled workers build equipment for experimental and pilot work and maintain the complex equipment and machinery. Maintenance mechanics and all-round machinists work in most atomic energy activities, as do electricians, plumbers, pipefitters, and other craftsmen and chemical process operators.



A laboratory ecologist uses a radiation-detecting instrument to measure radio-activity in a live fish.

Activities in the Atomic Energy Field

The following briefly describes some important atomic energy activities and their workers.

Uranium Exploration and Mining. The 6,500 people employed in uranium exploration and mining in 1972 had jobs similar to those in mining of other metallic ores. They mainly work in the Colorado Plateau area of the Far West, in the States of New Mexico, Wyoming, Utah, Colorado, and Arizona. A relatively few mines account for the bulk of production and employment. Most workers in uranium mines are in production jobs such as miners and drillers in underground mines, and truck drivers, bulldozer operators, and machine loaders at open pit mines. About 1 out of 8 employees in uranium exploration and mining is in a professional job, such as mining engineer or geologist.

Uranium Ore Milling. In uranium mills, metallurgical and chemical processes are used to extract uranium from mined ore. Uranium mills, located primarily in the Colorado Plateau, employed about 1,600 workers in 1972.

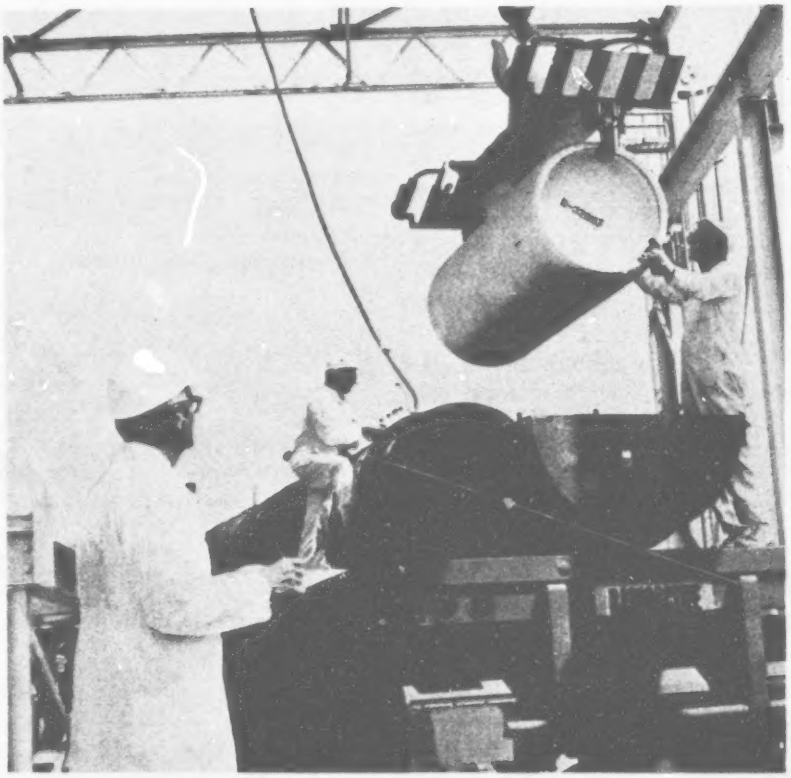
These mills employ skilled machinery repairmen, millwrights, pipefitters, carpenters, electricians, and chemical process operators. A small proportion of those working in

milling operations are scientists and engineers.

Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and converted to metal or intermediate chemical products for reactor fuel preparation. Conventional chemical and metallurgical processes are used, but they must meet more exacting standards than in most other industries. The output of refining plants may be further processed to obtain enriched uranium.

Activity in this segment of the atomic energy field is centered in Ohio, Tennessee, Kentucky, and Illinois. In 1972 uranium refining and enriching plants employed about 7,200 workers.

Maintenance craftsmen, particularly in the highly automated uranium enriching plants, account for a large proportion of skilled workers. Large numbers of chemical process operators also are employed. Chemical engineers and chemists account for more than a third of the engineers and scientists. Many of the technicians work in the chemical laboratories associated with production processes.



Workmen load cylinders of enriched uranium for shipment.

Reactor Manufacturing. About 23,500 people were employed in the design and manufacturing of nuclear reactors and reactor parts in 1972. Reactor manufacturers do extensive development work on reactors and auxiliary equipment, design the reactor, and generally build most of the intricate components, such as fuel elements, control rods, and reactor cores.

More than two-fifths of the employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent more than one-quarter of the employment. Most are mechanical engineers and reactor engineers who specialize in reactor technology. Most of the scientists are physicists, but many chemists, mathematicians, and metallurgists also are employed. Assisting these engineers and scientists are many draftsmen, engineering aids, and physical science technicians.

Skilled workers, mostly all-round machinists, are employed by reactor manufacturers in experimental, production, and maintenance work. Other craftsmen such as sheet metal workers, instrument makers, machinery repairmen, instrument repairmen, and electricians also are employed. Reactor manufacturers employ nuclear reactor operators to operate experimental and test reactors.

Reactor Operation and Maintenance. Almost 4,800 workers operated and maintained nuclear reactors in 1972. Nuclear power stations employ mechanical, electrical and electronic engineers, instrument and electronic technicians, radiation monitors, reactor operators, and other plant operators and attendants. Machinery and instrument repairmen, electricians, and pipefitters maintain and repair the reactors.

Research and Development Facilities. A number of research and development laboratories are operated for the AEC by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in engineering, physical and the life sciences, and in the development of nuclear reactors and other nuclear equip-

ment. More than half of the 42,500 employed in AEC research and development facilities are engineers, scientists, and supporting technicians, including radiation monitors.

Administrative and clerical workers account for a large proportion of employment. Skilled workers include large numbers of machinists, electricians, machinery repairmen, and millwrights, and many tool and die makers, instrument makers, and pipefitters. Nuclear reactor operators operate research and test reactors and many service workers are employed in plant protection and security operations.

Although most nuclear energy research is in AEC research and development facilities, additional research is done in privately owned research laboratories of educational institutions, other nonprofit institutions, and industrial concerns. Like the AEC facilities, these laboratories employ a large proportion of workers, nearly 3 out of 4, in scientific, engineering, and other technical jobs.

Production of Nuclear Weapons and Other Defense Materials. Establishments that produce nuclear weapons and weapon components, plutonium, and other defense materials employed more than 32,000 people in 1972. Skilled workers include large numbers of machinery repairmen and millwrights, chemical process operators, machinists, electricians, instrument repairmen, pipefitters, tool and die makers, and instrument makers.

Among the large number of scientists and engineers employed at these facilities are chemists, physicists, and mechanical, chemical, and electrical and electronic engineers. Many engineering and physical science aids, draftsmen, radiation monitors, and electronic technicians assist scientists and engineers.

Other Atomic Energy Activities. Nearly 1,400 workers produce special materials such as beryllium, zirconium, and hafnium for use in reactors. About 6,000 workers are in companies that make reactor control instruments, radiation detection and monitoring devices, and other instruments. Production of these instruments is similar to other instrument manufacturing. Large numbers of engineers and technicians are employed in these industries.

More than 800 people were employed by manufacturers of particle accelerators and their specialized components. Particle accelerators enable scientists to study the structure and properties of elementary particles in the nucleus of an atom. Workers employed in the design and manufacture of these machines include mechanical, electrical and electronic engineers, physicists, draftsmen, electronic technicians, and machinists.

Other workers process and package radioisotopes, produce radiography units and radiation gauges and package and dispose of radioactive wastes.

Government Employment. The Atomic Energy Commission, which

Plant ecologists investigate radio-activity in the soil.

directs the Federal Government's atomic energy program, employed more than 7,200 workers in its headquarters and field offices in 1972. About 1,800 were scientists and engineers. Since the AEC is primarily an adimistrative and regulatory agency, nearly 9 out of 10 employees are in administrative, professional, or clerical jobs. Several thousand employees are engaged in atomic energy work in other Federal agencies and in regulatory and promotional activities of State and local governments.

Unique Atomic Energy Occupations. Most of the occupations discussed in the preceding sections are similar to those found in other industrial activities, although they may have job titles unique to the atomic energy field (such as nuclear engineer, radiation chemist, and nuclear reactor operator) and require some specialized knowledge of atomic energy. (A detailed discussion of the duties, training, and employment outlook for most of these occupations appears elsewhere in the *Handbook*.)

The health physics occupations, which are unique to the atomic energy field, and some other occupations that require training in the field, or in the handling and use of radioactive materials or radiation-producing equipment, are discussed briefly in the following sections.

Health physicists (sometimes called radiation or radiological physicists or chemists) detect radiation and apply safety standards to control exposure to it. In 1972 nearly 1,200 health physicists were employed in radiation protection work, research, or teaching.

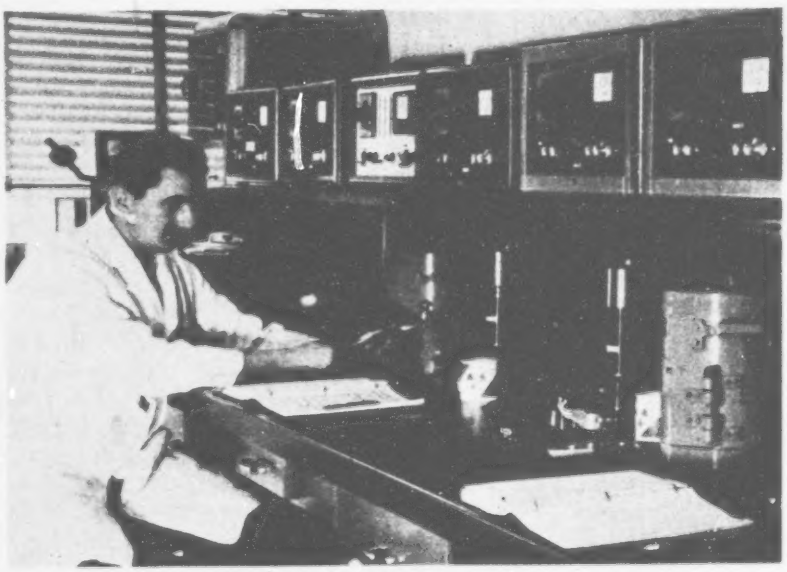
Health physicists are responsible for planning and organizing radiological health programs at atomic energy facilities. They establish inspection standards and determine procedures for protecting employees and eliminating radiological hazards. Some supervise the inspection of work areas with potential radiation hazards and prepare instructions covering safe work procedures.

Health physicists also plan and supervise training programs dealing with radiation hazards and advise others on methods of dealing with them. In some cases, they are employed on research projects dealing with the effects of human exposure to radiation and may develop procedures for using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. An estimated 1,800 radiation monitors were employed in the atomic energy field in 1972. They use special instruments to monitor work areas and equipment to detect radioactive contamination. Soil, water, and air samples are taken frequently to determine radiation levels. Monitors also may collect and analyze radiation detectors, such as film badges and pocket detection chambers, worn by workers.

Radiation monitors inform their supervisors when a worker's exposure to radiation or the level of radiation in a work area approaches a maximum limit and recommend work stoppage. They calculate the amount of time that personnel may work in contaminated areas, considering maximum radiation exposure limits and the radiation level. Monitors also give instructions in radiation safety procedures and prescribe special clothing requirements and other safety precautions for workers entering radiation zones.

Nuclear reactor operators perform work in nuclear power stations similar to that of boiler operators in conventional ones, however, the controls operated are different. In addition, they may assist in the loading and unloading of reactor cores. Nuclear reactor operators who work with research and test reactors check reactor control panels and adjust controls to maintain specified operating conditions within the reactor. Nearly 1,500 people worked as



Health physics technician counting routine smear surveys obtained from plant site.

nuclear reactor operators in 1972.

Accelerator operators set up and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, based on instructions from the scientist in charge of the experiment, and set up target materials that are to be bombarded by the particles. They also may help maintain equipment.

Radiographers take radiographs of metal castings, welds, and other objects by adjusting the controls of an X-ray machine, or by exposing a source of radioactivity to the object to be radiographed. They select the proper type of radiation source and film and use standard mathematical formulas to determine exposure distance and time. While taking radiographs, they use radiation detection instruments to monitor the work area for potential radiation hazards. Radiographers also may remove and develop the film plates and assist in their analysis.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells—rooms enclosed with radiation shielding materials such as lead and concrete. By controlling "slave manipulators" (mechanical devices that act as a pair of arms and hands) from outside the cell and observing their actions through the cell window, these technicians perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians also may enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. *Decontamination men* have the primary duty of decontaminating equipment, plant areas, and materials exposed to radiation. They use radiation-detection instruments to locate the contamination; eliminate it by the use of special equipment, detergents, and chemicals; and then verify the effectiveness of the process. *Waste-treatment operators* operate heat exchange units, pumps, compressors, and other equipment to decontaminate and dispose of radioactive waste liquids. *Waste-disposal men* seal contaminated wastes in concrete containers and transport the containers to a burial ground.

Radioisotope-production operators use remote control manipulators and other equipment to prepare radioisotopes for shipping and perform chemical analyses to ensure that radioisotopes conform to specifications.

Training and Other Qualifications

Training and education requirements and advancement opportunities for most workers in the atomic energy field are generally similar to those doing comparable jobs in other industries. These are discussed elsewhere in the *Handbook* under the specific occupation. However, specialized training is required for many workers because the field requires exacting work standards in both its research and production activities, and has unique health and safety problems.

Engineers and scientists at all levels of professional training work in the atomic energy field. Many have advanced training, particularly those doing research, development, and design work. About one-fourth of the scientists and engineers employed in research and development by major AEC contractors have a Ph.D. degree. The proportion of engineers with Ph.D. degrees is smaller than that of scientists. However, graduate training is preferred for an increasing number of both scientific and engineering jobs. Training in nuclear engineering, although increasing at the undergraduate level, is mostly at the graduate level.

The specialized knowledge of nuclear energy essential for most scientific and engineering positions can be obtained at a college or university or sometimes through on-the-job experience.

Colleges and universities have expanded their facilities and curriculums to provide training in nuclear energy. Engineers and scientists planning to specialize in the atomic energy field should take graduate work in nuclear energy, although introductory or background courses may be taken at the undergraduate level. Some colleges and universities award graduate degrees in nuclear engineering or nuclear science. Others offer graduate training in these fields, but award degrees only in the traditional engineering or scientific fields.

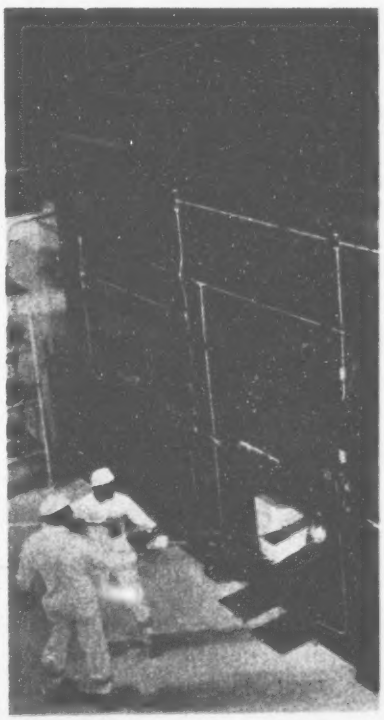
Health physicists should have at least a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics. A Ph.D. degree often is required for teaching and research.

Craftsmen doing some jobs in the atomic energy field need more training than those doing similar work in other industries. High skill requirements are often needed, because of the exact precision required to insure efficient operation and maintenance of complex equipment and machinery. For example, pipefitters may have to fit pipe to tolerances of less than one ten-thousands of an inch and work with pipe made from rare and costly metals. Welding also may have to meet higher reliability standards than in most fields. These craftsmen generally obtain the required specialized skills on the job. Many AEC installations also have apprentice-training programs to develop craft skills.

High school graduates with courses in mathematics, physics, and chemistry can qualify for on-the-job training as radiation workers. They

must become familiar with characteristics of radiation, maximum permissible radiation exposure levels, and methods of calculating exposure periods. They also must learn how to calibrate the instruments they use.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees are high school graduates. Trainees usually are selected from conventional power plant personnel with experience operating boiler, turbine, or electrical machinery. Preference may be given to those who complete college level courses in science and engineering. Workers operating nuclear reactor controls must be licensed by the AEC. To qualify for a license, the trainee must pass an operating and written test given by the AEC, along with a medical examination.



Technicians placing low level irradiated materials in hot cells through a special pass-through drawer.

An accelerator operator usually needs a high school education that includes courses in mathematics and physics to qualify for on-the-job training. Accelerator operators receive several months of on-the-job training covering operating, repair, and safety procedures. To qualify for on-the-job training as a radiographer, a high school education including courses in mathematics, chemistry, and physics usually is sufficient.

High school graduates who have some mechanical experience can qualify for on-the-job training as hot-cell technicians and decontamination men. The training may last several months. Radioisotope-production operators usually require a high school education with courses in chemistry. These graduates may also qualify as waste-treatment operators, since experience in reading electronic instruments or working in a chemical laboratory is desirable. High school graduates also can qualify for employment as waste-disposal men. They receive on-the-job training in operating equipment and avoiding radiation hazards.

Other workers in the atomic energy field also need special training because of potential radiation hazards. Employees who work in the vicinity of such hazards are always given on-the-job training in the nature of radiation and the procedures to follow in case of its accidental release.

Individuals who handle classified data (restricted for reasons of national security) or who work on classified projects in the atomic energy field must have a security clearance based on an investigation of a person's character, loyalty, and associations.

The Atomic Energy Commission, at its contractor-operated facilities, supports on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the atomic energy field.

Additional educational and training opportunities are offered in cooperative programs arranged by AEC laboratories with colleges and universities. Temporary employment at these laboratories is available to faculty members and students. Undergraduate and graduate engineering students may work at laboratories and other Commission facilities on a rotation basis, and many graduate students do their thesis work at AEC laboratories.

Many Commission contractors provide employees with training at their own plants or at nearby colleges and universities.

Employment Outlook

Job opportunities in the atomic energy field are expected to increase moderately through the mid-1980's as uses of atomic energy are expanded and new ones developed. In addition, others will be needed to replace workers who retire, die, or transfer to other occupations or industries.

Many factors point to a long-term expansion in this field. Increased expenditures for research and development should increase opportunities in both research and production activities. The use of nuclear reactors in electric power generating stations will become more widespread as the demand for electricity increases and other fuels become more scarce. Greater use of nuclear reactors for propulsion of surface ships and rockets is anticipated, although progress in this area may not be as rapid as in electric power generation.

Employment opportunities are ex-

pected to rise significantly for workers who design and manufacture nuclear power reactors and instruments, and who process and package radioisotopes. As more nuclear reactors are built and put into operation, opportunities will increase both in operation and maintenance jobs, and in related activities such as the fabrication and reprocessing of reactor fuel elements and the disposal of radioactive wastes. Employment in mining, milling, refining, and enrichment of uranium will increase as the demand for nuclear fuel increases. As more nuclear power is developed, additional regulatory workers will be needed to insure its safe use. Expansion in these areas of atomic energy should create favorable opportunities for trained professional and technical workers and for skilled craftsmen.

Earnings and Working Conditions

In 1972 blue-collar workers employed by contractors at AEC laboratories and other installations had average hourly earnings of $4.63; blue-collar workers in all manufacturing industries had average earnings of $3.62 an hour.

Professional workers employed at AEC installations averaged $16,600 a year in 1972, and other white-collar workers (largely clerical and other office personnel) averaged nearly $8,100 a year. (Earnings data for many of the occupations found in the atomic energy field are included in the statements on these occupations elsewhere in the *Handbook*.)

Working conditions in uranium mining and milling, instrument and auxiliary equipment manufacturing, and facilities construction are generally similar to those in other industries, except for radiation safety precautions. All uranium mines are equipped with mechanical ventilation systems that reduce the concentration of radioactive radon gas—a substance that can cause lung injury if inhaled over a number of years. Efforts to eliminate this hazard are continuing. In the other atomic energy activities working conditions generally are very good. Buildings and plants are well lighted and ventilated. Equipment, tools, and machines are modern and the most advanced of their type. Only a small proportion of employees in the atomic energy field actually work in areas where direct radiation dangers exist. Even in these areas, shielding, automatic alarm systems, and other devices and clothing give ample protection to the workers. In some cases, plants are located in remote areas.

Extensive safeguards and operating practices protect the health and safety of workers, and the AEC and its contractors have maintained an excellent safety record. The AEC regulates the possession and use of radioactive materials, and inspects nuclear facilities to insure compliance with health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

Most hourly paid plant workers belong to unions that represent their particular craft or industry.

Sources of Additional Information

Additional information about the atomic energy field is available from:

U.S. Atomic Energy Commission,
Washington, D.C. 20545.

OCCUPATIONS IN THE BAKING INDUSTRY

One of the largest food-processing employers in the United States, the baking industry provides steady, year-round employment for thousands of workers throughout the country. Jobs exist to suit a wide variety of interests, skills, and talents. Bakery workers make, wrap, pack, sell and deliver products. Mechanics maintain and repair plant machinery and service delivery trucks. Managers and sales specialists direct operations and clerical workers perform regular office duties.

Nature and Location of the Industry

The baking industry includes large wholesale bakeries that sell to retail stores, restaurants, hotels, and other large customers; bakeries owned and operated by grocery chains; and central baking plants of companies each operating several retail bake shops.

In 1972, the industry employed 271,000 workers in about 3,700 bakeries. Nearly 85 percent of these workers were employed in bakeries that produced perishable goods such as bread, rolls, pies, cakes and doughnuts. Most of these bakeries serve only local markets and employ an average of 50 workers; however, improvements in the highway system have allowed many to expand their markets and the size of their plants.

The remaining workers were employed in bakeries producing "dry" goods such as cookies, crackers, pretzels, and ice cream cones. These bakeries serve regional or even national markets and employ an average of 120 workers per plant.

Almost every community has at least one bakery, but nearly half of all industrial bakery employees work in California, Illinois, New Jersey, New York, Ohio, Pennsylvania and Texas.

Nearly 60 percent of the industry's employees are production workers. They do the actual baking, handle raw materials, maintain equipment, wrap and pack products, and keep the bakeries sanitary. Another 20 percent of the employees deliver the industry's products. Most of them are driver-salesmen who sell to retail stores. Other drivers with no sales duties deliver bakery products to distribution centers, hotels, restaurants, and stores. The remaining 20 percent of the work force are in administrative, professional, technical, and clerical jobs.

About one-fifth of the workers are women, most of them office workers such as secretaries or bookkeepers. Some have production jobs, such as slicing machine operator, wrapping machine operator, or pie and cake packer, but few women are bakers.

In addition to the industrial bakeries described, over 12,000 single-shop retail bakeries employed about 100,000 men and women including shop owners. Most retail shops had only 5 or 6 workers, but some had 20 or more. Because many operations in retail shops are done by hand rather than by machine, these shops offer skilled baking craftsmen many opportunities not available in industrial bakeries.

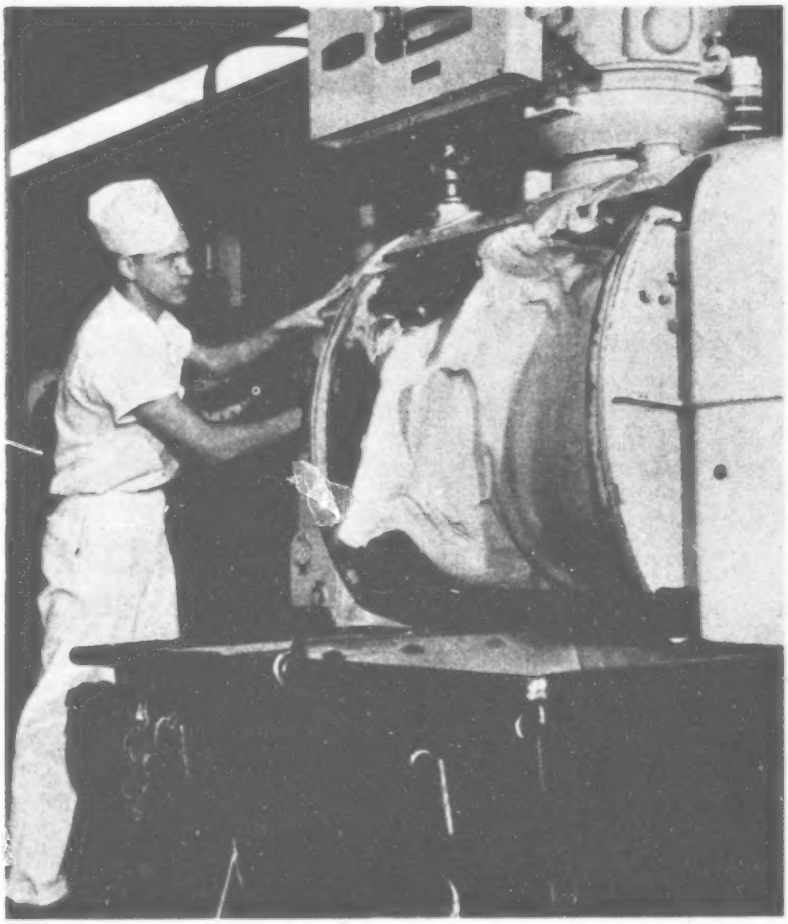
Production Occupations. Although not all baked goods are made in exactly the same way, most bakery production jobs are similar. Production workers blend, sift, and mix ingredients to form a dough; shape and bake the dough; and wrap and pack the final product.

Since bread is the primary product of the industry, occupations described here are those found in a bread bakery. Jobs may be somewhat different in a bakery which makes other products or is more automated.

The first step in baking is to combine the ingredients needed to make dough. *Mixers* (D.O.T. 520.885) load blending machines with the exact amounts of flour, water, and yeast needed for the bread. Using instruments, they carefully control the temperature, timing, and mixing speed of the machines to insure a uniform, well-blended dough. After the dough is mixed, it is dropped into a trough and pushed to a warm proofing room for the yeast to ferment and the dough to rise. The risen dough is poured back into the blender and sugar, salt, shortening, and more flour and water are added. The dough is allowed to rise again before it is shaped into loaves.

Dividermen (D.O.T. 526.728) operate machines which divide and roll the dough into loaf-size balls. A conveyor carries the balls of dough to *dough molders* or *molding machine operators* (D.O.T. 520.885) who press out the air bubbles, form the balls into loaves, and drop the loaves into pans. If fancy shaped bread or rolls are to be made, *bench hands* (D.O.T. 520.884) knead and form the dough by hand and place it in the pans.

The pans containing the dough go back to the proofing room for about an hour before being placed in the oven. *Ovenmen* (D.O.T. 526.885) load and unload the ovens and adjust the temperature and timing of the



ovens to make sure that the bread is properly baked.

Some bakeries use an automatic process called "continuous mix" that eliminates many of the steps described above. With this process all ingredients are mixed at once and the dough is divided, shaped, put into pans, and then proofed only once before baking.

In small bakeries, *all-round bakers* (D.O.T. 526.781), assisted by helpers, usually do all the steps needed to turn out finished baked products. In large bakeries, all-round bakers are employed as working foremen. They supervise the employees in their department and coordinate their activity with that in other departments to meet production schedules.

A considerable number of *helpers* (D.O.T. 526.886) are employed in baking operations. They may assist all-round bakers and other workers. They have job titles such as dough mixer helper, and ovenman helper. Helpers also perform such jobs as greasing pans, removing bread from pans, pushing troughs and racks, and washing pans.

After baked goods leave the oven and are cooled, several types of workers prepare them for delivery to customers. *Slicing-and-wrapping machine operators* (D.O.T 521.885) feed loaves of bread onto conveyors leading to the machines, watch the slicing and wrapping operations, adjust the machines, and keep them supplied with bags and labels. A conveyor then takes the wrapped loaves to the shipping platform.

Bakery employees in icing departments give finishing touches to cakes, pastries, and other sweet goods following special formulas of the bakery. *Icing mixers* (D.O.T. 520.885) prepare cake icings and fillings. They weigh and measure ingredients and mix them by machine. They also prepare cooked fillings for pies, tarts, and other pastries. *Hand icers* (D.O.T. 524.884) are skilled craftsmen who decorate special products such as wedding cakes, birthday cakes, and fancy pastries. When the product is uniform or requires no special decoration, the frosting may be applied by *machine icers* (D.O.T. 524.885).

Bakeries also employ many workers in storage, warehousing, and shipping departments. Receiving and stock clerks check, record, and deliver incoming supplies and ingredients to various departments. Packers and checkers make up orders of bakery products for delivery by driver-salesmen.

Maintenance Occupations. Bakeries employ skilled maintenance workers such as machinists, electricians, and stationary engineers to keep machinery and equipment in good condition. Large plants need many of these workers because their baking operations are highly mechanized. Many bakeries also employ truck mechanics to service their fleets of delivery trucks.

Sales and Driving Occupations. Selling and delivering finished baked foods to customers requires many thousands of workers. Some sell baked goods, some drive trucks, and many do both.

Driver-salesmen, also called route-

men (D.O.T. 292.358), work for wholesale bakeries. They deliver, and collect payment for baked foods to grocery stores along their routes. Attracting new customers and urging old customers to buy more products are a major part of their job. Driver-salesmen arrange their baked goods on shelves or display racks in grocery stores and may restock shelves several times a day in busy stores. They also list items they think grocers will buy the next day that are used to make up production schedules for the next morning.

Route supervisors assign delivery routes and check delivery schedules. A large bakery may employ several of these workers, each in charge of 6 to 10 driver-salesmen. In a smaller bakery, one supervisor may be in charge of all salesmen. Route supervisors also train new driver-salesmen, and many temporarily replace salesmen who are absent.

Chain grocery store bakeries and multioutlet retail bakeries employ truckdrivers rather than driver-salesmen to deliver baked foods to each of their company's stores. Stock clerks or sales clerks arrange the display of baked foods in the stores.

Administrative, Clerical, and Professional and Technical Occupations. Administrators in large bakeries and owners of small bakeries coordinate all baking activities, from the purchase of raw materials to the production and delivery of finished products. In large firms, activities are divided into separate departments or functions and are supervised by plant managers, comptrollers, sales managers, and other executives. Some administrative employees specialize in fields such as accounting, purchasing, advertising, personnel and industrial relations. Bakeries employ many types of clerical workers, including bookkeepers, cashiers, clerks, business machine operators, typists, and switchboard operators. A large proportion of these office workers are women. Some large baking companies have laboratories and test kitchens where chemists, home economists, and their assistants test ingredients and prepare formulas and recipes. (Detailed discussion of the duties, training, and employment outlook for maintenance, sales, driving, administrative, clerical, and technical personnel appear elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

Training requirements for occupations in the baking industry range from a few days on the job to several years of experience or advanced education. Slicing and wrapping machine operators can learn their job in a few days, but skilled workers, such as all-round bakers, mixers, ovenmen and other baking specialists, need three or four years of training. Professional personnel and some administrative workers must have a college degree or considerable experience in their specialty.

Most inexperienced production workers in the baking industry are hired as helpers (utility workers). They are usually assigned such tasks as carrying ingredients to mixing machines, or pushing troughs of dough to the proofing room. Helpers are often able to learn more advanced baking skills while working alongside experienced bakers, and may be selected to enter an apprenticeship program. Employers usually require an apprentice to be between 18 and 26 years of age and to have a high school or vocational school diploma. Apprenticeship programs last 3 or 4 years, and include on-the-job training in all baking operations and classroom instruction in related subjects.

Some workers take courses in vocational school or learn baking in the Armed Forces. Such training may not qualify a person as a skilled baker, but it may help him to become an apprentice and perhaps shorten his apprenticeship.

Training programs for unemployed and underemployed workers seeking entry jobs as bakers or cake decorators are in operation in several cities under provisions of the Manpower Development and Training Act.

Bakers may be promoted to jobs such as working or department foremen. Some bakers who have developed special skill in fancy cakemaking or piemaking may find jobs in hotel or restaurant bakeries. All-round bakers with some business ability sometimes open their own bakeshops.

Bakery employees must be in good health because most States require a health certificate indicating that the worker is free from contagious diseases. Good health also is important because of the irregular working hours and high temperature in bakeries.

Some bakeries have apprenticeship programs for maintenance jobs such as machinists, electricians, and mechanics. Other plants hire inexperienced workers as mechanics' helpers, who gain experience and know-how while working with skilled mechanics. Some bakeries hire only skilled maintenance men.

For jobs as driver-salesmen or truckdrivers, baking firms generally hire inexperienced young men with a high school education. These workers often begin as stock clerks, packers, or checkers, and are promoted to driving jobs. Applicants must be able to get a chauffeur's license and are sometimes tested by the baking companies to determine whether they are safe drivers. Classroom instruction in sales, display, and delivery proce-

dures is sometimes given to new driver-salesmen, but most training is given on the job by route supervisors. Driver-salesmen may be promoted to route supervisor and sales manager.

Administrative jobs are usually filled by upgrading personnel already employed in the firm. Some owners and production managers of bakeries have come from the ranks of baking craftsmen and some began their careers in sales occupations. In recent years, large baking firms have required their new administrative workers to have a college degree in an administrative field, such as marketing, accounting, labor relations, personnel, or advertising. Kansas State University at Manhattan offers a bachelor of science degree in baking science and management. The American Institute of Baking conducts a school of baking for persons with a bachelor's degree who wish to qualify for managerial positions.

Young persons who have completed a commercial course in high school, junior college, or a business school usually are preferred for secretarial, stenographic, and other clerical jobs.

Employment Outlook

Employment in the baking industry is expected to decline slowly through the mid-1980's. Nevertheless, several thousand job openings are anticipated each year because of the need to replace workers who retire, die, or transfer to other fields of work.

Despite a growing demand for bakery products due to population growth, fewer production workers will be needed because processes are becoming more efficient. Pneumatic handling systems and pumps can transfer ingredients from trucks or railroad cars to storage containers quickly and easily. The "continuous mix" process eliminates dough mixing and proofing operations, and conveyor systems can be used to move panned dough from ovens to labeling machines in one continuous process. In addition, bakeries can prepare a week's baked foods at one time and store them in the freezer until ready for sale.

Despite the anticipated decline in the number of production workers, employment in some occupations is expected to increase. More truck drivers will be needed as suburban developments spread and sales territories expand. As bakeries become more mechanized additional maintenance workers will be needed to keep equipment in operating order. Some increase may occur in the number of clerical workers as bakeries become larger.

Earnings and Working Conditions

In 1972, earnings of production workers in the baking industry averaged $147.31 a week, or $3.72 an hour, which is slightly less than the average for all manufacturing industries. Bakeries producing perishable products generally offer higher wages than those producing "dry" products. Wage rates also tend to be higher in the West and North than in the South and Southwest.

According to union contracts covering employees in 24 wholesale bakeries producing bread and related products, minimum hourly rates in major occupations in 1972 were as follows:

Baking foremen and all-round bakers	$ 4.35–5.79
Molders and dividers and molding and dividing machine operators	3.23–5.34
Mixers (dough or icing)	3.42–5.34
Ovenmen	3.42–5.34
Benchmen	3.42–5.25
Icers and decorators	3.70–4.54
Wrapping machine operators	3.42–4.48
Utilitymen (general helpers)	2.66–4.12
Porters and cleaners	3.13–4.74

Some plant employees work night

shifts and weekends because many plants do baking around the clock. Workers receive extra pay for night work. Some bakeries are eliminating the night shift since baked goods can be frozen and stored until needed. Most plant workers are on a 40-hour workweek, but some work 35 or 37-1/2 hours, and others 44 to 48 hours regularly.

Driver-salesmen usually receive a guaranteed minimum salary plus a percentage of their sales. According to limited information from union contracts, driver-salesmen for wholesale bakeries had minimum weekly salaries of from $98 to $189 in 1972. By selling more baked products to more customers, driver-salesmen can increase their earnings. Companies generally pay for uniforms and their maintenance.

Working conditions in bakeries are generally good. However, many jobs involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens can be hot, especially in the summer.

Nearly all employees of industrial baking firms get paid vacations, which usually range from 1 to 5 weeks according to length of service. Employees also get from 5 to 11 paid holidays, depending on the locality. Most baking firms have life and health insurance programs and retirement pension plans. Many employees are covered by joint union-industry plans which are paid for entirely by the employer.

Most bakery workers belong to labor unions. Bakers and other plant workers are organized by the Bakery and Confectionary Workers' International Union of America, and driver-salesmen and transport drivers usually are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some maintenance workers are members of craft unions such as the International Association of Machinists and Aerospace Workers and the International Union of Operating Engineers.

Sources of Additional Information

Information on local baking jobs and training opportunities may be obtained from bakeries in the community, local offices of the State employment service, or locals of the labor unions noted previously.

General information on job opportunities in the industry and on schools which offer courses or degrees in baking science and technology may be obtained from:

American Bakers Association, 1700 Pennsylvania Ave. NW., Washington, D.C. 20006.

Information on opportunities in retail bakeries may be obtained from:

Associated Retail Bakers of America, 731-735 W. Sheridan Rd., Chicago, Ill. 60613.

OCCUPATIONS IN THE DRUG INDUSTRY

References to potions and spells for the cure and prevention of pain and disease are numerous in medical folklore. But twentieth-century science has created a supply of drugs undreamed of by even the most imaginative apothecaries of the past.

More than 10,000 prescription drugs are available to today's physician. These drugs have resulted in the control of cardiovascular disease, malaria, pneumonia, and even some forms of cancer. Hormones have relieved the pain and crippling effects of arthritis and other diseases. Tranquilizers and other drugs have done much to reduce the severity of mental illness. Vaccines have reduced dramatically the toll of polio, whooping cough, and measles. Discoveries in veterinary medicine have increased animal productivity and controlled various diseases, some of which are transmissible to man.

The American drug industry has risen to a position of worldwide prominence in its record of research and development in new drugs, spending a higher proportion of its funds for research than any other American industry. A large pharmaceutical firm may test 4,000 or more substances a year and spend millions of dollars to develop one new drug.

Although the drug industry looks to its many scientific and technical personnel to carry out its vast research programs, 3 out of every 5 jobs in the industry do not require more than a high school education.

Nature and Location of the Industry

In 1972, nearly 150,000 persons worked in the drug industry. About 120,000 of these worked in plants that made pharmaceutical preparations (finished drugs), such as tranquilizers, antibiotics and analgesics. Another 17,000 worked in plants that produced bulk medicinal chemicals and botanicals used in making finished drugs; and about 13,000 worked in plants that made biological products, such as serums and vaccines.

Drug manufacturing plants typically employ large numbers of workers. About two-thirds are in plants having more than 500 workers, and some of the largest plants employ more than 5,000.

Nearly three-fourths of the industry's workers were employed in six States: New Jersey, New York, Indiana, Pennsylvania, Illinois, and Michigan. Large plants are located in Indianapolis, Ind.; Chicago, Ill.; Nutley and Rahway, N.J.; Philadelphia, Pa.; Detroit and Kalamazoo, Mich.; and Pearl River, N.Y.

One of the industry's most striking characteristics is the emphasis on discovery of new products, numbering more than 150 in the last ten years. Because of this emphasis, the drug industry has an above-average concentration of its employees in research and development activities.

For testing new drugs, a primary research method is used, called screening. In screening an antibiotic, for example, a sample is placed in a bacterial culture. If positive results follow, the antibiotic is next tested on infected laboratory animals. Promising compounds are studied further for evidence of useful—and harmful—effects. A new drug will be selected for testing in man only if it promises to have therapeutic advantages over comparable drugs already in use, or if it offers the possibility of being safer.

Research is important to the drug industry.

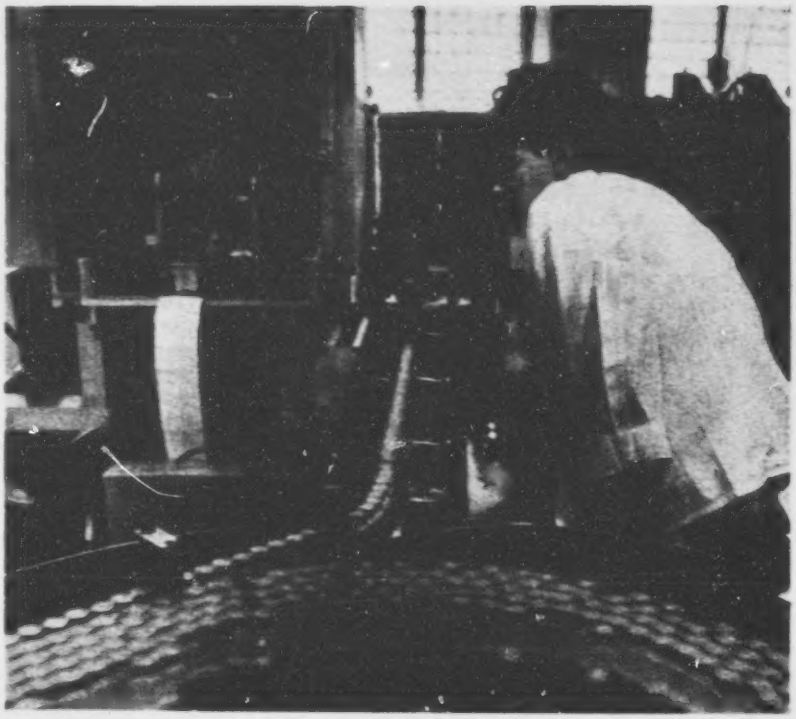
After laboratory screening, a clinical investigation, or trial of the drug on human patients, is made. Supplies of the drug are given to a small circle of doctors who administer it to carefully selected consenting patients. The patients are then observed closely and special studies made to determine the drug's effect. If a drug proves useful, arrangements are made for more tests with a larger group of physicians, including some in private practice.

Once a drug has successfully passed animal and clinical tests and has been approved by the Food and Drug Administration (FDA), problems of production methods and costs must be worked out before manufac-

turing begins. If the original laboratory process of preparing and compounding the ingredients is complex and expensive, pharmacists, chemists, packaging engineers, and production specialists are assigned to develop processes economically adaptable to mass production.

Drug manufacturers have developed a high degree of automation in many production operations. Milling and micronizing machines (which pulverize substances into extremely fine particles) are used to reduce bulk chemicals to the required size. These finished chemicals are combined and processed further in mixing machines. The mixed ingredients may then be mechanically capsulized, pressed into tablets, or made into solutions. One type of machine, for example, automatically fills, seals, and stamps capsules. Other machines fill bottles with capsules, tablets, or liquids, and seal, label, and package the bottles.

Drug products are inspected at various stages during the manufacturing process to insure that they conform to specifications. Although some inspection operations are mechanized, many are performed manually.



Quality control is a vital part of the drug production process.

Occupations in the Industry

Workers with many different levels of skill and education work in the drug industry. More than half are in white-collar jobs (scientific, technical, administrative, clerical, and sales); most of the remainder are in plant jobs (processing or production, maintenance, transportation, and custodial). Two-fifths of the drug industry's workers are women, larger than the proportion in most other manufacturing industries.

The duties of some of the important occupations are described briefly below. (Detailed discussion of professional, technical, clerical and other occupations found in drug manufacturing, as well as in other industries, are given elsewhere in the *Handbook*, in the sections covering individual occupations.)

Scientific and Technical Occupations. About 1 out of every 5 employees in the industry is a scientist, engineer, or technician—a far greater proportion than in most other industries. The majority research and develop new drug products. Others work to streamline production methods and improve quality control.

Chemists (D.O.T. 022.081) comprise the largest number of scientific and technical personnel in the industry. Organic chemists combine new compounds for biological testing. Physical chemists separate and identify substances, determine molecular structure, help to create new compounds and improve manufacturing processes. Biochemists study the action of drugs on body processes. Radiochemists trace the course of drugs through body organs and tissues. Pharmaceutical chemists set standards and specifications for form of product and storage conditions and see that labeling and literature meet the requirements of State and Federal laws. Analytical chemists test raw and intermediate materials and finished products for quality.

Several thousand *biological scientists* (D.O.T. 041.081, .181) work in the drug industry. Biologists and bacteriologists study the effect of chemical agents on infected animals. Microbiologists grow strains of microorganisms which produce antibiotics. Physiologists investigate the effect of drugs on body functions and vital processes. Pharmacologists and zoologists study the effect of drugs

on animals. Virologists grow viruses, develop vaccines, and test them in animals. Botanists, with their special knowledge of plant life, contribute to the discovery of botanical ingredients for drugs. Some other biological scientists include pathologists, who study normal and abnormal cells or tissues, and toxicologists, who are concerned with the safety, dosage levels, and the compatibility of different drugs. Pharmacists perform research in product development, studying many forms of medicines at various stages of production. Some set specifications for the purchase and manufacture of materials, and handled correspondence relating to products. Drug manufacturers also employ physicians and veterinarians.

Engineers make up a small fraction of scientific and technical employmert. *Chemical engineers* (D.O.T. 008.081) design equipment and devise manufacturing processes. *Industrial engineers* (D.O.T. 012.081, .168, .187, .188, and .281) plan equipment layout and workflow to maintain efficient use of plant facilities. *Mechanical engineers* (D.O.T. 007.081, .151, .181, and .187) coordinate the installation and maintenance of sterilizing, heating, cooling, humidifying, and ventilating equipment.

Technicians (D.O.T. 073.381, 078.128, .168, .281, .381, and 687) represent about one-fourth of the drug industry's scientific and technical workers. Laboratory tests play an important part in the detection and diagnosis of a disease and in the discovery of medicines. Laboratory technicians perform these tests under the direction of scientists in such areas as bacteriology, biochemistry, microbiology, virology (the study of viruses), and cytology (analysis of cells).

Administrative, Clerical, and Related Occupations. About 1 out of every 3 workers in drug manufacturing is in an administrative, clerical, or other office job. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, marketing, and types of products to research and develop. Other administrative and executive workers are accountants, lawyers, purchasing agents, personnel and industrial relations workers, and advertising and marketing research workers. Clerical employees keep records on personnel, payroll, raw materials, sales, shipments, and plant maintenance.

Pharmaceutical detail men (D.O.T. 266.158) represent a small but important group of drug industry employees. Detail men promote their companies products. They visit practicing and teaching physicians, pharmacists, dentists, and hospital administrators to provide information on the latest drugs.

Plant Occupations. Nearly half of the industry's employees work in plant jobs. The majority of these workers can be divided into three major occupational groups: production or processing workers who operate the drug producing equipment; maintenance workers who install, maintain, and repair this equipment; and shipping clerks, truck drivers, and material handlers who help transport the drugs.

Pharmaceutical operators (D.O.T. 559.782) control machines that produce tablets, capsules, ointments, and medicinal solutions. *Granulator machine operators* (D.O.T. 559.782) tend milling and grinding machines that reduce mixtures to designated sizes particles. *Compounders* (D.O.T. 550.885) tend tanks and kettles in which solutions are mixed and compounded to make up creams, ointments, liquid medications, and powders. *Compressors* (D.O.T. 556.782) operate machines that compress ingredients into tablets. *Pill and tablet coaters* (D.O.T. 554.782) control a battery of machines that apply coatings to tablets to flavor, color, preserve, add medication, or control disintegration time. *Tablet testers* (D.O.T. 559.687) inspect tablets for hardness, chippage, and weight to assure conformity with specifications.

Ampoule fillers (D.O.T. 559.885) operate machines that fill small glass containers with measured doses of liquid drug products. *Ampoule examiners* (D.O.T. 559.687) examine the ampoules for discoloration, foreign particles, and flaws in the glass.

After the drug product is prepared and inspected, it is bottled or packaged. Most of the packaging and bottle filling jobs are done by semiskilled workers who operate machines that measure exact amounts of the product and seal containers.

The drug industry employs many skilled maintenance workers to assure that production equipment is operating properly and to prevent costly breakdowns. Included among maintenance workers are power plant operators who are responsible for high pressure boilers, turbo generators, compressors, refrigeration equipment, and plant water systems; electricians who install, maintain and repair the various types of electrical equipment; pipefitters who install and maintain heating, plumbing, and pumping systems; machinists who make and repair metal parts for machines and equipment; and instrument repairmen who periodically inspect instruments and controls and repair or replace malfunctioning parts.

Plant workers who do not operate or maintain equipment perform a variety of other tasks. Some drive trucks to make deliveries to other parts of the plant; some load and un-

Medications are packaged on this production line.

load trucks and railroad cars; others keep inventory records. The industry also employs custodial workers, such as guards and janitors, whose duties are similar to those of such workers in other industries.

Training, Other Qualifications, and Advancement

The training requirements for jobs in the drug industry range from a few hours of on-the-job training to years of preparation.

For production and maintenance occupations, drug manufacturers generally hire inexperienced workers and train them on the job; high school graduates are preferred by most firms. Beginners in production jobs assist experienced workers, while learning the operation of the processing equipment. With experience, an employee may advance to more skilled jobs in his department. Most maintenance jobs are filled by people who start as helpers to electricians, pipefitters, machinists, and other craftsmen.

Many companies encourage production and maintenance workers to take courses related to their jobs in local schools and technical institutes, or to enroll in correspondence courses. Some companies reimburse the workers for part, or all, of the tuition. Skilled production and maintenance workers with leadership ability may advance to supervisory positions.

For technicians in the drug industry, methods of qualifying for jobs vary in many ways. Most technicians enter the field with a high school education and advance to jobs of greater responsibility with experience and additional formal education. However, companies prefer to hire men and women who are graduates of technical institutes or junior colleges, or those who have completed college courses in chemistry, biology, mathematics, or engineering. In many firms, inexperienced workers begin as laboratory helpers or aids, performing routine jobs such as cleaning and arranging bottles, test tubes, and other equipment.

The experience required for higher levels of technician jobs varies from company to company. Generally, a minimum of one year of experience is required for assistant technician jobs, 3 years for technicians, 6 years for senior technicians, and 10 years for technical associates. Some companies require senior technicians and technical associates to complete job-related college courses.

For most scientific and engineering jobs, a bachelor of science degree is the minimum requirement. Some companies have formal training programs for young college graduates with engineering and scientific backgrounds. These trainees work for brief periods in the various divisions of the plant to gain a broad knowledge of drug manufacturing operations before being assigned to a particular department. In other firms, newly employed scientists and engineers are immediately assigned to a specific activity such as research, process development, production, or sales.

Job prospects and advancement are usually best for professionals with advanced degrees. Some companies offer training programs to help scientists and engineers keep abreast of new developments in their fields and to develop administrative skills. These programs may include meetings and seminars with consultants from various fields. Many companies encourage scientists and engineers to further their education; some provide financial assistance for this purpose. Publication of scientific papers is also encouraged.

Employment Outlook

Drug manufacturing employment is expected to grow very rapidly

through the mid-1980's. In addition to the jobs produced by employment growth, many openings will result from the need to replace experienced workers who retire, die, or transfer to other fields of work.

The demand for drug products is expected to grow very rapidly. Demand will be stimulated primarily by the expected increase in population—particularly the growing number of older people and children. Other factors which are expected to increase the demand for drugs include greater personal income, the rising health consciousness of the general public, growth of coverage under health insurance programs and Medicare, and the discovery of new drugs to treat illnesses not yet responding to therapy. A continued rise in drug sales to other countries also is anticipated.

The industry's employment will not increase as rapidly as the demand for drug products, because technological improvements in production methods will increase output per worker. The more widespread use of automatic processing and control equipment in operations formerly done by hand will tend to reduce labor requirements, particularly in plants where common drugs are mass-produced.

Rates of employment growth will vary among occupations. The numbers of scientists, engineers, detail men, technicians, and maintenance workers are expected to increase faster than those of other occupational groups in the industry. Demand for scientists, engineers, and technicians will be spurred by continued expansion of research and development activities. The increasingly technical nature of the detail man's job and the rising sales of drug products are expected to make this one of the most rapidly growing occupations in the industry. More skilled maintenance men (such as electricians, machinists, pipefitters, and instrument repairmen) will be needed to service the growing amount of automatic processing and control equipment. Employment of administrative and clerical workers is expected to increase moderately; however, most semiskilled plant occupations are expected to increase slowly, as more processes are adapted to automatic equipment.

Earnings and Working Conditions

Earnings of plant workers in the drug industry are higher than the average for manufacturing industries. For example, in 1972, production workers in the drug industry averaged $3.98 an hour, while those in manufacturing as a whole averaged $3.81 an hour.

National wage data are not available for individual occupations in the drug industry. However, statements on specific occupations, such as chemist, pharmacist, and technician, in other parts of the *Handbook*, will give general earnings information.

Some employees work in plants that operate around the clock—three shifts a day, 7 days a week. In most plants, workers receive extra pay when assigned to second or third shifts. Drug production is subject to little seasonal variation so work is steady.

Paid vacations and holidays are typical benefits in this industry. Workers generally receive 2 weeks of vacation after 1 year, and progressively longer vacations based on length of employment. Most workers also receive health and life insurance and pension benefits, financed at least partially by their employers. Employee stock-purchase plans are available in many firms.

Working conditions in drug plants are better than in most other manufacturing plants. Much emphasis is placed on keeping equipment and work areas clean because of the danger of contamination to drugs. Plants are usually air-conditioned, well-lighted, and quiet. Ventilation systems protect workers from dust, fumes, and disagreeable odors. Special precautions are taken to protect the relatively small number of employees who work with infectious cultures and poisonous chemicals. With the exception of work performed by materials handlers and maintenance workers, most jobs require little physical effort. The frequency of injuries in drug manufacturing has been about half the average for all manufacturing industries in recent years.

Many of the industry's employees are members of labor unions. The principal unions in the industry are the Oil, Chemical and Atomic Workers International Union; the International Chemical Workers Union; and District 50, United Mine Workers of America (Ind.).

Sources of Additional Information

Further information about careers in drug manufacturing may be obtained from the personnel departments of individual drug manufacturing companies and from:

Pharmaceutical Manufacturers Association, 1155 Fifteenth St. NW., Washington, D.C. 20005.

National Pharmaceutical Council, Inc., 1030 15th St. NW., Washington, D.C. 20005.

ELECTRONICS

An astronaut, a doctor, and a businessman all have something in common; without electronic devices they would be unable to do much of their work. We would never have reached the moon without the thousands of men and women working in electronics research and production. Nor would doctors be able to diagnose and treat many diseases without modern electronic machines. Businessmen also owe a lot to electronics. Electronic computers for example, have helped them in such areas as inventory control, market research, and production schedules.

Nature and Location of the Industry

The birth of the electronics industry dates back to the early 1920's when the first radios were produced. By the end of World War II the industry had diversified its production to include defense equipment. With the development of television and the computer, the electronics industry expanded even further to manufacture a wide range of products.

Today the industry is broken into four main market areas: government products, industrial products, consumer products, and components. Products sold to the government make up a large portion of total electronic sales. Included in government purchases are widely different products such as missile and space guidance systems, communications systems and other electronic goods used in medicine, education, crime detection and traffic control.

Electronic products have become an important part of daily business operations. Industrial purchases include computers, radio and television broadcasting equipment, and production control equipment.

Consumer products are probably the most familiar types of electronic products. Every day thousands of people buy television sets, radios, microwave ovens, and tape recorders.

Components are needed to manufacture and repair electronic products. Some of the most well-known components are transistors, television picture tubes, and amplifiers.

About 1.3 million workers were employed in the electronics industry in 1972. About 960,000 worked in plants that produce end products for government, industrial and consumer use. The rest worked in plants that made electronic components.

Electronics manufacturing workers can find jobs throughout the country, but the majority of the jobs in 1972 were in eight States: California, New York, New Jersey, Illinois, Massachusetts, Ohio, Pennsylvania, and Indiana. Metropolitan areas with large numbers of electronics manufacturing workers include Chicago, Los Angeles, New York, Philadelphia, Newark, Boston, Baltimore, and Indianapolis.

In addition to employees in electronics manufacturing plants, electronics workers were employed by the Federal government in activities such as research, development, and contract negotiations. Universities and nonprofit research centers employed a relatively small number of electronic workers.

Occupations in the Industry

A wide variety of jobs were in the electronics manufacturing industry. About half of all workers are in plant jobs that include production, maintenance, transportation, and service occupations. The rest were scientists, engineers and other technical workers, and administrative, clerical, and sales workers.

More than two-fifths of the electronics manufacturing workers are women. In some plants, women account for half or more of total employment.

Professional and Technical Occupations. The electronics industry is very dependent on research and development. As a result, a large proportion of its workers are in engineering, scientific, and other technical jobs. Engineers and scientists alone represent about 1 out of every 9 electronics workers.

Electrical and electronics engineers, the largest group of engineers in the industry, work on research and development and production and quality control problems. Most of these engineers are highly specialized, however, and may work in only one specific area such as data systems, space exploration, or radar.

Mechanical engineers help develop new products and design tools and equipment. Industrial engineers work on production problems or on efficiency, methods or time studies. Chemical, metallurgical and ceramic engineers also work for electronics companies.

Physicists work on research-and-development projects such as designing more simplified circuits used in many color television sets.

Chemists and metallurgists work mainly in research and in materials preparation and testing. Mathematicians and statisticians help engi-

neers and scientists on complex mathematical and statistical problems, especially in the design of military and space equipment and computers. Statisticians also are employed in quality control, production scheduling, and sales analysis and planning. Industrial designers are concerned with the design of electronic products and the equipment used to manufacture them.

Technicians—such as electronics technicians, draftsmen, engineering aids, laboratory technicians, and mathematical assistants—represent about 1 out of every 20 electronics manufacturing workers. Many electronics technicians help engineers design and build experimental models. They also set up and repair electronic equipment for customers. Other electronics technicians do complex inspection and assembly work. Draftsmen prepare drawings from sketches or specifications furnished by engineers.

Engineering aids assist engineers by making calculations, sketches, and drawings, and testing electronic components and systems. Laboratory technicians help physicists, chemists, and engineers in laboratory analyses and experiments. Mathematical assistants follow procedures outlined by mathematicians to solve problems. They also operate test equipment to develop computers and other electronic products.

Technical writers prepare training and technical manuals that describe the operation and maintenance of electronic equipment. They also prepare catalogs, product literature, and contract proposals. Technical illustrators draw pictures of electronic equipment for technical publications and sales literature.

Administrative, Clerical, and Related Occupations. About 1 out of 5 workers in electronics manufacturing has an administrative or other office job. Administrative workers include purchasing agents, sales executives, personnel specialists, advertising workers, and market researchers. Secretaries, typists, and business machine operators are among the thousands of other office workers employed by electronics firms. A growing proportion of these office workers operate computers.

Plant Occupations. About half of electronics manufacturing employees work in plant operations: assembly, inspecting, machining, fabricating, processing, and maintenance.

Assembly Occupations (D.O.T. 729.884; 720.884; 726.781 and .884). Assemblers, most of whom are semiskilled workers, make up the largest group of employees. Most end products are assembled by hand with small tools, soldering irons, and light welding machines. Assemblers use diagrams to guide their work. Some assembly is done by following instructions presented on color slides and tape recordings. Color slide projectors flash a picture of an assembly sequence on a screen, while the assembler listens to recorded directions.

Precision assemblers and electronics technicians install components and subassemblies in complex products such as missiles. They also help make experimental models. Most of these workers are employed in the manufacture of military and industrial electronic equipment.

Machines are used in some assembly work. For example, in putting together circuit boards, automatic machines often are used to position components on boards and

to solder connections. Here the assemblers work as machine operators or loaders. Most components are put together by machines, since their assembly involves simple and repetitive operations. Even some types of miniaturized semiconductors and other components, made with parts small enough to pass through a needle's eye, are assembled by machines.

Hand assembly is needed for some items, such as receiving tubes and some types of resistors and diodes. Hand assemblers may do only a single operation as components move down the production line, but some put together complete components. Tiny parts often are assembled under magnifying lenses or microscopes. Precision welding equipment may be used to weld connections in microminiature components and circuit assemblies.

Machining Occupations. Machining workers are needed in most electronics manufacturing plants, particularly for military, space, and industrial products. Machine-tool operators and machinists make precise metal parts. Toolmakers construct and repair jigs and fixtures that hold metal while it is being stamped, shaped, or drilled. Diemakers build metal forms (dies) used in stamping and forging metal.

Fabricating Occupations. Fabricating workers are employed in many electronics manufacturing plants, but most are in plants that make industrial products. Sheet-metal workers make frames, chassis, and cabinets. *Glass blowers* and *glass lathe operators* (D.O.T. 674.782) make tubes for experimentation and development work.

In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.884) wind fine wire around two heavy parallel wires to make grids (devices in tubes that control the flow of electrons). Other fabricating workers include *coil winders* (D.O.T. 724.781 and .884), *crystal grinders* and *finishers* (D.O.T. 726.884), and *punch press operators* (D.O.T. 617.885).

Processing Occupations. Many electronic workers process or prepare parts for assembly. *Electroplaters* and *tinners* (D.O.T. 501.885) coat parts with metal; *anodizers* (D.O.T. 501.782) treat these parts in electrolytic and chemical baths to prevent corrosion. Other processing workers also coat electronic components with waxes, oils, plastics, or other materials. Some operate machines which encase microminiature components in plastic. *Silk screen printers* (D.O.T. 726.887) print patterns on circuit boards and on parts of electronic components. *Etching equipment operators* (D.O.T. 590.885) do chemical etching of copper on circuit boards.

Another group of processing workers operate furnaces and ovens to harden ceramics and eliminate contamination by gases and foreign materials. *Operators of infrared ovens and hydrogen furnaces* (D.O.T. 590.885) rid tubes of foreign deposits. In tube manufacturing, *exhaust operators* (D.O.T. 725.884) and *sealers* (D.O.T. 692.885) operate gas flame machines that clear the tube of impurities, exhaust the gas, and seal the tube.

Inspection Occupations. Inspection begins when raw materials enter the plant and continues through manufacturing. Some inspection jobs require electronics technicians who have years of experience. These jobs are commonly found in complex production work such as the manufacture of computers and spacecraft. Most inspectors, however, do not need extensive technical training.

Some inspectors check incoming parts and components supplied by other firms. They may have job titles such as incoming materials inspector or plating inspector that indicate the work they do.

During manufacturing, components are either checked manually by workers using test meters or routed mechanically through automatic test equipment. Although many of these workers simply are called testers, others have job titles such as transformer-tester or coil-tester, that reflect the type of components they inspect. Some automatic equipment can check components, produce a punched tape of the results, and sort the components into batches for shipping. Workers who feed or monitor automatic equipment often are called test-set operators or testing-machine operators.

Electronic assembly inspectors (D.O.T. 722.281) examine assembled products to make certain that they conform to blueprints and specifications. They inspect wiring, electrical connections, and other critical items to make sure everything will work properly.

Maintenance occupations. Many workers repair machinery and equipment. Skilled electricians are responsible for the proper operation of electrical equipment. Machine and equipment repairmen make mechanical repairs. Maintenance machinists and welders build and repair equipment and fixtures. Air-conditioning and refrigeration mechanics work in air-conditioned plants that have special refrigerated and dust-free rooms to protect sensitive parts. Painters, plumbers, pipefitters, carpenters, and sheet-metal workers also are employed in electronics plants.

Other plant occupations. Many workers move and handle materials. Forklift operators stack crates in warehouses, and load and unload

trucks and boxcars. Truckdrivers move freight outside the plant. The industry also employs guards, watchmen, and janitors.

(Detailed discussions of professional, technical, mechanical, and other occupations, found not only in electronics manufacturing plants, but also in other industries, are given elsewhere in the *Handbook* in sections covering the individual occupations.)

Training, Other Qualifications, and Advancement

Training requirements for jobs in electronics manufacturing plants range from a few hours of on-the-job training to years of specialized preparation. Beginning engineering jobs usually are filled by recent college graduates, but some positions call for advanced degrees. A small number of workers without college degrees, however, are upgraded to professional engineering classifications from occupations such as engineering assistant and electronics technician. Workers who become engineers in this way usually take advanced electronics courses in night school or in other training programs. To keep up with new developments and to qualify for promotion, professional and technical personnel obtain additional training, read technical publications, and attend lectures and technical demonstrations.

Almost all mathematicians, physicists, and other scientists employed in electronics manufacturing have college degrees; many have advanced degrees. Job prospects are usually better for scientists who have at least a master's degree.

Technicians generally need specialized training to qualify for their jobs. Most electronics technicians attend either a public, private, or Armed Forces technical school. Some complete 1 or 2 years of college in a scientific or engineering field, and some receive training through a 3- or 4-year apprenticeship program. High school graduates who have had courses in mathematics and science are preferred for apprenticeship programs.

Some workers advance to electronics technicians positions from jobs such as tester or laboratory assistant. A relatively small number of plant workers become technicians. Opportunities for advancement are improved by taking courses in company-operated classes, night school, junior college, technical school, or by correspondence.

Electronics technicians need good color vision, manual dexterity, and good eye-hand coordination. Some technicians who test radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radio-telephone operators.

Draftsmen usually take courses in drafting at a trade or technical school; a few have completed a 3- or 4-year apprenticeship. Under an informal arrangement with their employers, some qualify for both on-the-job training and part-time schooling. Because many draftsmen in this industry must understand the basic principles of electronic circuits, they should study basic electronic theory.

Technical writers must have a flair for writing and usually are required to have some technical training. Employers prefer to hire those who have had some technical institute or college training in science or engineering. Many, however, have college degrees in English or journalism and receive their technical training on the job and by attending company-operated evening classes. Technical illustrators usually have attended art or design schools.

Many tool and die makers, machinists, electricians, and other craftsmen learn their trades by completing a 4- or 5-year apprenticeship; others are upgraded from helpers' jobs.

Formal training is not necessary for workers entering plant jobs, but a high school diploma or its equivalent is frequently required. Job applicants may have to pass aptitude tests and demonstrate skill for particular types of work. A short period of on-the-job training generally is provided for inexperienced workers. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Requirements for administrative and other office jobs are similar to those in other industries. Some beginning administrative jobs are open only to college graduates with degrees in business administration, law, accounting, or engineering. For clerical jobs, employers usually prefer high school graduates with training in stenography, typing, bookkeeping, and office machines.

Employment Outlook

Employment in electronics manufacturing is expected to increase very rapidly through the mid-1980's. In addition to the jobs from employment growth, large numbers of openings will arise as experienced workers retire, die, or take jobs in other industries.

The employment outlook presented here assumes relatively full employment, and strong growth in the economy. It also assumes that defense spending, an important determinant of electronics manufacturing employment, will be lower than the level during the Vietnam conflict in the late 1960's. If the Nation's economic activity and defense spending should differ substantially from the assumed levels, employment will be affected accordingly.

Production of electronic products will increase as business-men buy more computers and other electronic equipment to automate paper work and production processes. Business spending for electronic communication and testing equipment also will grow. The demand for consumer goods such as television receivers and stereo systems, will rise as population and personal incomes grow. Government purchases for defense will continue to account for a large proportion of electronics manufacturing output. An increasing share of government purchases, however, is likely to be for electronic equipment used in medicine, education, pollution abatement, and other fields.

The rates of employment growth will vary among occupational groups and individual occupations. For example, employment of skilled maintenance workers is expected to rise at a more rapid rate than total employment, because of the need to repair the increasing amounts of complex machinery. On the other hand, employment of assemblers probably will rise at a slower rate, because of the growing mechanization and automation of assembly line operations.

Employment of engineers, scientists, and technicians is expected to increase faster than total employment, because of continued high expenditures for research and development and the manufacture of more complex products. Among professional and technical workers, the greatest demand will be for engineers, particularly those who have a background in certain specialized fields, such as quantum mechanics, and solid-state circuitry, product design, and industrial engineering. Many opportunities also will be available for engineers in sales departments because the industry's products will require salesmen with highly technical backgrounds. The demand for mathematicians and physicists will be particularly good because of expanding research in computer and laser technology.

Earnings and Working Conditions

As shown in the accompanying table, in 1972 electronics production workers who made government and industrial end products had higher average hourly earnings than production workers in all types of manufacturing. Those making other electronic products, however, made less than the average for all manufacturing industries.

Type of product	*Production workers' average hourly earnings, 1972*
All manufacturing industries	$3.81
Major electronics manufacturing industries	
Government and industrial electronics end products	4.06
Radio and television receiving sets, and phonographs	3.33
Electron tubes	3.64
Semiconductors and other components, except tubes	2.99

Electronics workers generally receive premium pay for overtime work and for work on Sundays and holidays. Virtually all plants provide extra pay for evening and night shift work.

Many workers in electronics manufacturing plants receive 2 or 3 weeks' vacation with pay and from 6 to 8 paid holidays a year. Almost all electronics workers are covered by health and life insurance plans; many are covered by pension plans and other fringe benefits.

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants are usually well-lighted, clean, and quiet. Many plants are relatively new, and are located in suburban and semirural areas. The work in most occupations is not strenuous but assembly line jobs may be monotonous.

The injury rate in electronics manufacturing is far below the average in manufacturing as a whole, and injuries usually are less severe.

Many workers in electronics manufacturing are union members. The principal unions involved are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists and Aerospace Workers; and the United Electrical, Radio and Machine Workers of America (Ind.).

Sources of Additional Information

Further information about careers in this field can be obtained from the public relations departments of electronics manufacturing companies, the unions listed, and from the Electronic Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

OCCUPATIONS IN FOUNDRIES

Metal castings produced by foundry workers are essential for thousands of products ranging from missiles to cooking utensils. In 1972, about 310,000 people worked in the foundry industry. Thousands of others worked in the foundry departments of plants in other industries, such as automobile and machinery manufacturing.

Casting is a method of forming metal into intricate shapes. To cast metal, a mold is prepared with a cavity shaped like the object to be cast. Metal is then melted and poured into the mold to cool and solidify. The strength of metal which has been cast makes it suitable for many household and industrial items.

Nature and Location of the Foundry Industry

Nearly three-fourths of the foundry industry's employees work in iron and steel foundries. The remainder work in plants that cast nonferrous metals, such as aluminum and zinc. Foundries usually specialize in a limited number of metals, because different methods and equipment are needed to melt and cast various alloys.

There are six principle methods of casting, each named for the type of mold used. In the most common method, green-sand molding, a special sand is packed around a pattern in a boxlike container called a flask. After the pattern is withdrawn, molten metal is poured into the mold cavity to form the desired metal shape. Sand molds can be used only once. A second method, called permanent molding, employs a metal mold that can be used many times. Permanent molding is used chiefly for casting nonferrous metals. Precision investment casting, a third method (often called the lost wax process), uses ceramic molds. A wax or plastic pattern is coated with refractory clay; after the coating hardens, the pattern is melted and drained so that a mold cavity is left. Castings produced from these molds are precise and require little machining.

Shell molding, a fourth process, is becoming increasingly important. In this method, a heated metal pattern is covered with sand coated with resin. The sand forms a thin shell mold that, after curing, is stripped from the pattern. Castings produced from these molds are precise and have a smooth surface. Die casting, a fifth process, is done mostly by machines. Molten metal under high pressure is forced into dies from which the castings are later automatically ejected or removed by hand. A sixth method, centrifugal casting, is used to make pipe and other products that have cylindrical cavities. Molten metal is poured into a spinning mold where centrifugal force distributes the metal against the walls of the mold.

Most foundries are small. More than 90 percent employ fewer than 250 workers, although several of the largest employ more than 5,000 workers.

Small foundries generally produce a variety of castings in small quantities. They employ hand and machine molders and coremakers (the key foundry occupations) and a substantial number of unskilled laborers. Large foundries are often highly mechanized and produce great quantities of identical castings. These shops employ relatively few unskilled laborers, because cranes, conveyors, and other types of equipment replace hand labor in the moving of materials, molds, and castings. Since much of the casting in large shops is mechanized, they also employ proportionately fewer skilled molders and coremakers than small shops. However, many skilled maintenance workers, such as millwrights and electricians, are employed to service and repair the large amount of machinery.

Machine molder produces sand molds.

Though every State has some foundry employment, jobs are concentrated in States which have considerable metalworking activity; for example, in Michigan, Ohio, Pennsylvania, Illinois, Indiana, and Wisconsin.

Foundry Occupations

Most of the industry's 310,000 employees in 1972 were plant workers.

More than half of the plant workers were in occupations not found in other industries. To illustrate more clearly the duties of these workers, a brief description of the jobs involved in the most common casting process—sand casting—follows:

After the casting is designed, the *patternmaker* (D.O.T. 600.280 and 661.281) makes a wood or metal pattern in the shape of the casting. Next, a *hand molder* (D.O.T. 518.381) makes sand molds by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 579.782), around the pattern. A *molder's helper* (D.O.T. 519.887) may assist in these operations. If large numbers of identical castings are to be made, machines may be used to make the molds at a faster speed than is possible by hand. The operator of this equipment is called a *machine molder* (D.O.T. 518.782).

A *coremaker* (D.O.T.518.381 and .885) shapes sand into cores (bodies of sand that make hollow spaces in castings). Most cores are baked in an oven by a *core-oven tender* (D.O.T. 518.885). Core sections are put together by a *core assembler* (D.O.T. 518.887). After the cores are assembled, they are placed in the molds by *core setters* (D.O.T. 518.884) or molders. Now, the molds are ready for the molten metal.

A *furnace operator* (D.O.T. 512.782) controls the furnace that melts the metal which a *pourer* (D.O.T. 514.884) lets flow into molds. When the castings have solidified, a *shakeout man* (D.O.T. 519.887) dumps them, and sends them to the cleaning and finishing department.

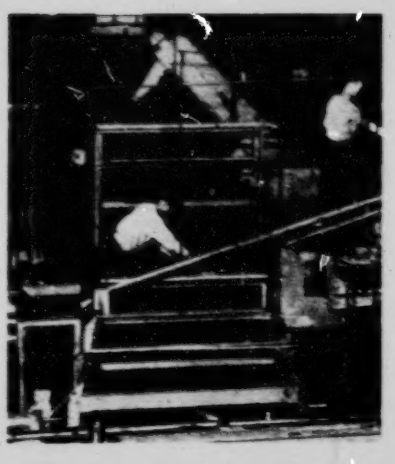
Dirty and rough surfaces of castings are cleaned and smoothed. A *shotblaster* (D.O.T. 503.887) operates a machine that cleans the castings by blasting them with air mixed with metal shot or grit. The castings may be smoothed by tumbling. In this process, the castings together with an abrasive material and sometimes water are placed in a barrel which is rotated. The man who controls the barrel is called a *tumbler operator* (D.O.T. 599.885). Sandblasters and tumbler operators may also operate a machine that both tumbles and blasts the castings. A *chipper* (D.O.T. 809.884) and a *grinder* (D.O.T. 809.884) use pneumatic chisels, powered abrasive wheels, powersaws, and handtools, such as chisels and files, to remove excess metal and to finish the castings.

Castings are frequently heat-treated in furnaces to strengthen the metal; a *heattreater*, or *annealer* (D.O.T. 504.782), operates these furnaces. Before the castings are packed for shipment, a *casting inspector* (D.O.T. 514.687) checks them to make sure they are structurally sound and meet specifications.

Many foundry workers are employed in occupations that are common to other industries. For example, maintenance mechanics, machinists, carpenters, and millwrights maintain and repair foundry equipment. Crane and derrick operators and truckdrivers move materials from place to place. Machine tool operators finish castings. Foundries also employ thousands of workers in unskilled jobs, such as guard, janitor, and laborer.

About a sixth of all foundry workers are employed in professional, technical, administrative, clerical, and sales occupations. Of these personnel, the largest number are clerical workers, such as secretaries, typists, and accounting clerks.

Foundries also employ substantial numbers of professional workers. Engineers and metallurgists do research; design machinery and plant layout; control the quality of castings; or supervise plant operations and maintenance. In recent years, many of these workers have been hired to sell castings and to assist customers in designing cast parts. Most foundry technicians are concerned with quality control. For example, they may test molding and coremaking sand, make chemical analyses of metal, and operate machines that test the strength and hardness of castings.



Coresetter places cores in the mold.

Administrative workers employed in foundries include office managers, personnel workers, purchasing agents, and plant managers.

The foundry work force is predominately male, since much of the work is strenuous. Women are employed primarily in office jobs, although some are employed in production occupations such as coremaker. Women also assemble wax and plastic patterns in investment casting foundries.

Detailed discussions of three principal foundry occupations—patternmakers, coremakers, and molders—appear elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most workers start in unskilled jobs, such as laborer or helper, and,

after receiving on-the-job training from a foreman or experienced worker, gradually learn more skilled jobs. This is the usual practice, in training workers for casting process jobs such as melter, chipper, and grinder.

Some skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. In this training, young workers receive supervised on-the-job training for 4 to 5 years, usually supplemented by classroom instruction. Management prefers workers who have completed an apprenticeship, because they have a greater knowledge of all foundry operations and are therefore better qualified to fill supervisory jobs.

An increasing number of skilled foundry workers learn their jobs through a combination of trade school and on-the-job training; in some cases, trade school courses may be credited toward completion of formal apprenticeships. Some foundries and the American Foundry Society Training and Research Institute conduct training programs to update and upgrade the skills of experienced workers.

Employment Outlook

Employment in the foundry industry is expected to show little or no change through the mid-1980's. Nevertheless, thousands of job openings will become available each year because of the need to replace experienced workers who retire, die, or transfer to other fields of work.

Population growth and higher incomes will create a demand for more automobiles, household appliances, and other consumer products that have cast parts. More castings also will be needed for industrial machinery as factories expand and modernize. However, technological developments will enable foundries to meet the increased demand for castings without increasing employment significantly. Continued improvements in production methods will result in greater output per worker.

Although foundry employment as a whole is not expected to change significantly through the mid-1980's, employment will rise in some occupations. For example, employment of scientists and engineers is expected to increase because of expanding research and development activities. Technicians also will be needed in greater numbers to help improve quality control and production techniques. More maintenance workers will be hired to keep the industry's growing amount of machinery in working order. In contrast, machine molding and coremaking will be substituted for hand processes, and will limit the need for additional hand molders and hand coremakers. As more machinery for materials handling is introduced, employment of laborers and other unskilled workers will decline.

Earnings and Working Conditions

Production workers in foundries have higher average earnings than those in manufacturing as a whole. In 1972, production workers in iron and steel foundries averaged $4.34 an hour, and those in nonferrous foundries averaged $3.92. By comparison, production workers in all manufacturing industries averaged $3.81 an hour.

Contracts between foundry companies and unions generally provide for fringe benefits, such as holiday and vacation pay, life and health insurance, and retirement pensions.

Working conditions in foundries have improved in recent years. Many foundries have changed plant layout and installed modern ventilating systems to reduce heat, fumes, and smoke. Although the injury rate in foundries is higher than the average for manufacturing, employers and unions are attempting to reduce injuries by promoting safety training.

Foundry workers belong to many unions, including the International Molders' and Allied Workers' Union; the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Many patternmakers are members of the Pattern Makers' League of North America.

Sources of Additional Information

Further information about work opportunities in foundry occupations may be obtained from local foundries, the local office of the State employment service, the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Information also is available from the following organizations:

American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill. 60016.

Cast Metals Federation, Cast Metals Federation Building, 20611 Center Ridge Rd., Rocky River, Ohio 44116.

Foundry Educational Foundation, 1138 Terminal Tower, Cleveland, Ohio 44113.

International Molders' and Allied Workers' Union, 1225 East McMillan St., Cincinnati, Ohio 45206.

OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

Industrial chemical products are the raw materials for all kinds of everyday items, from nylon stockings to automobile tires. Chemicals are also used to treat drinking water, to propel rockets, and to make steel, glass, explosives, and thousands of other items. The discovery of nylon, plastics, and other new products has helped the manufacture of industrial chemicals become one of the Nation's most important industries.

About 520,000 people in many different occupations worked in the industrial chemical industry in 1972. Training varies from a few days on the job for some plant workers, to college degrees for engineers and chemists.

Nature of the Industry

The industrial chemical industry produces organic and inorganic chemicals, plastics, and man-made rubber and fibers. Unlike drugs, paints, and other chemical products sold directly to consumers, other industries use "industrial chemicals" to make their own products.

Chemical products are made from coal, petroleum, limestone, mineral ores, and many other raw materials. After these materials go through chemical reactions, the finished products are vastly different from the original ingredients. Some plastics, for example, are made from natural gas.

In a modern chemical plant automatic equipment controls the dissolving, heating, cooling, mixing, filtering, and drying processes that convert raw materials to finished products. This equipment regulates the combination of ingredients, flow of materials, and the temperature, pressure, and time for each process. Materials are also moved automatically from one part of the plant to another by conveyors or pipes. Because of this automatic equipment, relatively few workers can produce tons of chemicals in one continuous operation.

About two-thirds of the 3,000 industrial chemical plants in the United States have fewer than 50 workers. Over half of the industry's employees, however, are concentrated in large plants with more than 500 workers.

Chemical plants are usually close to manufacturing centers or near the sources of raw material. Many plants that produce chemicals from petroleum, for example, are near the oil fields of Texas, California, and Louisiana. Although industrial chemical workers are employed in almost every state, about half of them work in Tennessee, New Jersey, Texas, Virginia, West Virginia, Ohio, and South Carolina.

Occupations in the Industry

Workers with many different skills and levels of education work in the industrial chemical industry. Research scientists, engineers, and technicians develop products, and design equipment and production processes. Workers with many skills are in processing, maintenance, and other plant jobs. Administrators, professionals, and clerical workers handle financial and business matters, keep records, and advertise and sell chemical products. About 1 out of 8 workers in the industry is a woman.

Scientific and technical occupations. The industrial chemical industry is one of the Nation's major employers of scientific and technical workers: 1 out of 5 of its employees a scientist, engineer, or technician. Many of them work in research and testing laboratories. An even larger number are administrators, salesmen, or production supervisors.

Chemists are the largest and most important group of scientists in the industry. Through basic and applied research, chemists learn about the properties of chemicals to find new and improved products and production methods. Their efforts have led to the discovery of plastics, nylon, man-made rubber, and many other items.

Chemists also work in activities other than research and development. A large number supervise plant workers or analyze and test chemical samples to insure the quality of the final product. Others work as administrators, marketing experts, chemical salesmen, and technical writers.

Engineers are another important group of industrial chemical workers. Using their knowledge of both chemistry and engineering, chemical engineers convert laboratory processes into large scale production methods. They design chemical plants and processing equipment, and sometimes supervise construction and operation. Chemical engineers also fill sales, customer service, market research, plant management and technical writing jobs.

Mechanical engineers design power and heating equipment. They also work with chemical engineers to design processing equipment, and supervise its installation, operation,

and maintenance. Electrical engineers design electric and electronic instruments and control devices, and facilities for generating and distributing electric power.

Many technical workers assist scientists and engineers. Laboratory technicians conduct tests and record the results in charts, graphs, and reports which are used by chemists and chemical engineers. Their work may range from simple routine tests to complicated analyses. Draftsmen provide engineers with specifications and detailed drawings of chemical equipment.

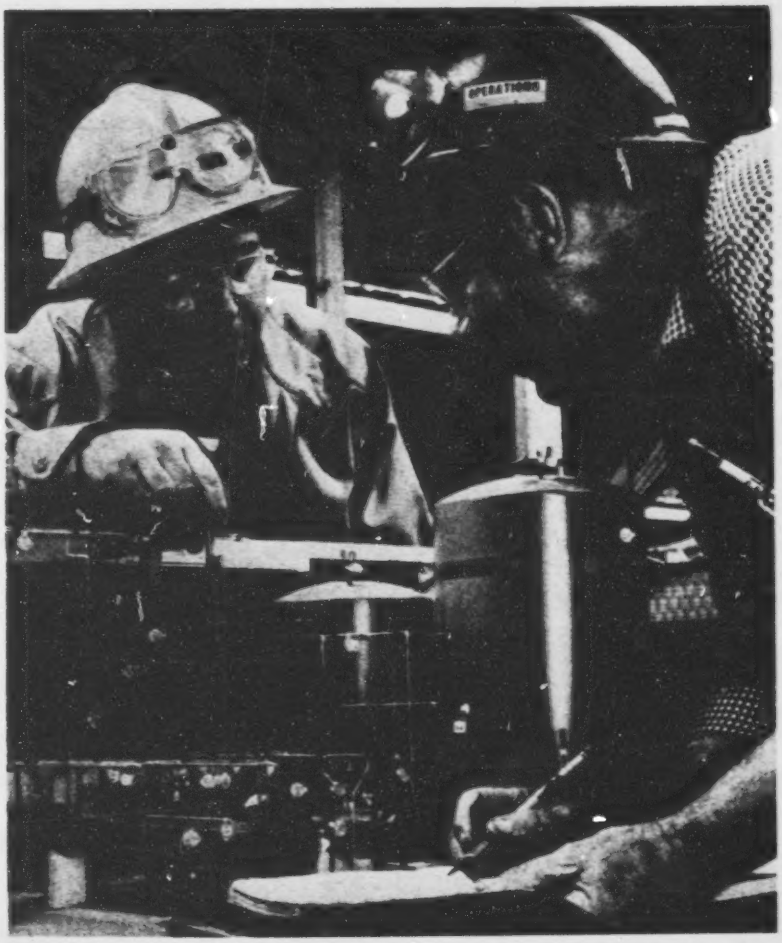
Plant Occupations. About 3 out of every five industrial chemical workers operate or maintain equipment or do other plant jobs.

Skilled *chemical operators* (D.O.T. 558.885 and 559.782) and their helpers are the largest group of plant workers. They set dials, valves, and other controls on automatic equipment to insure that the right temperature, pressure, and amounts of material are used. As chemicals are processed, operators read instruments that measure pressure, flow of materials, and other conditions. They also use instruments to test chemicals or send chemical samples to the testing laboratory. Operators keep records of instrument readings and test results and report equipment breakdowns. Chemical operators are sometimes called filterers, mixers, or some other title, depending on the kinds of equipment they operate.

To keep production processes running smoothly, instruments must give accurate measurements and equipment must withstand corrosion, damaging chemicals, high temperatures, and pressure. Many skilled maintenance workers keep this equipment in good condition. Pipefitters and boilermakers lay out, install, and repair pipes, vats, and pressure tanks; maintenance machinists make and repair metal parts for machinery; electricians maintain and repair wiring, motors, and other electrical equipment; and instrument repairmen install and service instruments and control devices. In some chemical plants one worker may do several of these jobs. Plant workers are also employed in many other jobs. They drive trucks, keep inventory of stock and tools, load and unload trucks, ships, and railroad cars, keep the plant and office clean, and do many other kinds of work.

Administrative, clerical, and related occupations. About 1 out of 4 industrial chemical workers holds an administrative, clerical, or other nonscientific white-collar job. High-level managers generally are trained in chemistry or chemical engineering. These executives decide what products to manufacture, where to build plants, and how to handle the company's finances. Executives depend on specialized workers including accountants, sales representatives, lawyers, industrial and public relations workers, market researchers, computer programmers, and personnel and advertising workers. Many secretaries, typists, payroll and shipping clerks and other clerical employees work in offices and plants.

(Individual statements elsewhere in the *Handbook* give detailed dis-



Engineers review model of chemical plant.

cussions of many scientific, technical, maintenance, and other occupations found in the industrial chemical industry, as well as other industries.)

Training, Other Qualifications, and Advancement

Jobs in the industrial chemical industry require from a few days on-the-job training to many years of preparation. Some plant workers can learn their jobs in a day or two. Scientists, engineers, technicians, and chemical operators, on the other hand, spend several years learning their skills.

Engineers and scientists must have at least a bachelor's degree in engineering, chemistry, or related science. Some research jobs, however, require advanced degrees or specialized experience. Many scientists and engineers attend graduate courses at company expense.

Some firms have formal training programs for newly hired scientists and engineers. Before they are assigned to a particular job, these employees work briefly in various departments to learn about the company's overall operation. In other firms, junior scientists and engineers are assigned immediately to a specific job.

Technicians qualify for their jobs in many ways. Graduates of technical institutes, junior colleges, or vocational technical schools have the best opportunities. Companies also hire students who have completed part of the requirements for a college degree, especially if they have studied mathematics, science, or engineering. High school graduates with courses in chemistry can qualify through on-the-job training and experience. Many technicians receive additional technical school or undergraduate training through company tuition-refund programs.

Laboratory technicians usually start as trainees or assistants, and draftsmen begin as copyists or tracers. As they gain experience and show ability to work without close supervision, these technicians advance from routine work to more difficult and responsible jobs.

Industrial chemical firms generally hire and train inexperienced high school graduates for processing and maintenance jobs. Equipment operators and other processing workers usually start out in a labor pool where they are assigned jobs such as filling barrels or moving materials. A worker may be transferred from the labor pool to fill a vacancy in one of the processing departments. As he gains experience he moves to more skilled processing jobs. Thus, a worker may advance from laborer to chemical operator helper, and then to chemical operator. Skilled processing workers are rarely recruited from other plants.

Most maintenance workers are trained on the job. Chemical companies often have formal maintenance training programs, including some classroom instruction, which may last from a few months to

several years. Instrument repairmen sometimes attend training programs offered by instrument manufacturers. Maintenance workers and trainees are encouraged to take job-related courses at local vocational or technical schools. Their employers may pay part or all of the tuition.

Administrative jobs are usually filled by men and women with college degrees in business administration, accounting, economics, statistics, marketing, industrial relations, and other fields. Chemists and engineers also hold administrative jobs. Some companies have advanced training programs for new administrative employees.

Secretaries, bookkeepers, and other clerical workers generally have had commercial courses in high school or business school.

Chemical operators monitor instrument panel.

Employment Outlook

Production of industrial chemicals will increase rapidly through the mid-1980's. However, continued shortages of petroleum, the raw material for many chemical products, will limit production. Employment will grow slowly as new chemical plants, improved equipment, and better production methods help workers produce more chemicals with less effort. The industry will still need many new workers each year, mainly to replace employees who retire, die, or transfer to other industries. Job openings from deaths and retirements alone will average several thousand a year.

Some groups of workers will grow faster than others. The number of administrative, professional, technical and clerical workers will grow faster than the number of plant workers. Because of the industry's emphasis on research and development, the largest increase will be for chemists, engineers, and science and engineering technicians.

Most of the additional plant jobs will be for instrument repairmen, pipefitters, electricians, and other craftsmen needed to care for new and more complex equipment. Process equipment operators, however, will remain the largest group of workers in the industry.

Earnings and Working Conditions

Production workers in the industrial chemical industry have relatively high earnings because a large proportion of them are in skilled jobs. In 1972 they averaged $4.60 an hour in plants making organic and inorganic chemicals, and $4.10 an hour in plants making plastics and man-made rubber and fibers. The average for production workers in all manufacturing was $3.81 an hour.

National wage data is not available for individual occupations in the industrial chemicals industry. However, in 1972 hourly wages in a few union-management contracts were as follows:

	Hourly rates
Chemical operators	$4.10–5.25
Instrument repairmen	4.50–5.40
Pipefitters, boilermakers, and sheet-metal workers	4.30–5.25
Laboratory technicians	4.30–5.25
Laboratory assistants	4.00–4.30

Industrial chemical workers receive many fringe benefits, including sick leave, retirement plans, and life, health, and accident insurance. Most workers also receive paid vacations ranging from 2 weeks after 1 year of employment, to 5 weeks after 20 years.

Because chemical plants usually operate around the clock—three shifts a day, 7 days a week—processing workers can expect to work the second or third shift, usually for extra pay. Shift assignments are rotated, so an individual may work

days one week and nights the next. Maintenance workers usually work only the day shift.

Most industrial chemical jobs, except those for laborers or materials handlers, are not strenuous. Equipment operators are on their feet most of the time. Some workers must climb stairs or ladders to considerable heights, or work outdoors in all kinds of weather. Workers may be exposed to dust, disagreeable odors, or high temperatures, although most plants have ventilating or air-conditioning systems.

Many chemicals are dangerous to touch or breathe, but the industrial chemical industry has one of the best safety records in the Nation. Protective clothing, eye glasses, showers, and eye baths near hazardous work stations and other safety measures help prevent serious injuries.

Many production workers in the industrial chemical industry belong to labor unions including the International chemical Workers Union; Oil, Chemical, and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

Further information on careers in the industry may be obtained from employment offices of industrial chemical companies, locals of the unions mentioned above, and from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

OCCUPATIONS IN THE IRON AND STEEL INDUSTRY

Steel is the backbone of any industrialized economy. There is hardly a product in daily use that has not been made from steel or processed by machinery made of steel. In 1971, U.S. steelmakers produced approximately 120 million tons of raw steel—about one-fifth of the world's output.

About 573,000 wage and salary workers were on the payrolls of the iron and steel industry's more than 940 plants in 1972. Employees work in a broad range of jobs that require a wide variety of skills. Many of these jobs are found only in iron and steelmaking or finishing.

The iron and steel industry, as discussed in this chapter, consists of blast furnaces, steelmaking furnaces, and rolling mills. The mining and the processing of raw materials used to make steel and the fabrication of steel are not described. (Employment opportunities in foundry, forging, and machining occupations are discussed elsewhere in the *Handbook*.)

Blast furnaces make iron from iron ore, coke, and limestone. Steelmaking furnaces refine the iron into steel. Mills shape the steel into sheets, plates, bars, strips, and various other basic products. Many mills also produce finished items, such as pipe and wire. Most basic steel products, however, are shipped to the plants of other industries.

The leading steel-consuming industries manufacture automobiles, construction materials, machinery and machine tools, containers, and household appliances. Steel sheets are made into automobile bodies, appliances, and furniture. Steel bars are used to make parts for machinery and to reinforce concrete in building and highway construction. Steel plates become parts of ships, bridges, railroad cars, and storage tanks. Strip steel is used to make pots and pans, razor blades, toys, and many other items.

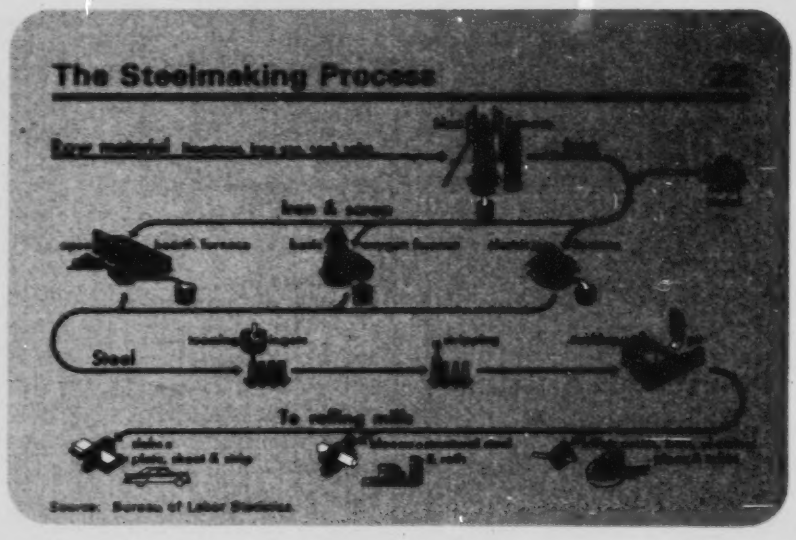
Individual plants in the iron and steel industry typically employ a large number of workers. About 80 percent of the industry's employees work in plants which have more than 2,500 employees. A few plants have more than 20,000. Many plants, however, have fewer than 100 employees, particularly those plants which make highly specialized steel products.

Iron and steel plants are located mainly in the northern and eastern parts of the United States. The heart of U.S. steel manufacturing is a triangular area, about 250 miles on a side, marked off by Johnstown, Pa., Buffalo, N.Y., and Detroit, Mich. Included in this area are major steel producing centers such as Pittsburgh, Pa., and Cleveland and Youngstown, Ohio. Large plants also are located on the south shore of Lake Michigan near Chicago. The Nation's two largest steel plants are located at Gary, Ind., and Sparrows Point, Md. (near Baltimore). Much of the steelmaking in the South is in the vicinity of Birmingham, Ala., and Houston, Tex. Other steelmaking facilities are located in the Far West at Pueblo, Colo.; Provo, Utah; and Fontana and near San Francisco, Calif.

About 7 out of 10 of the industry's workers are employed in five States—Pennsylvania, Ohio, Indiana, Illinois, and New York. Pennsylvania alone accounts for nearly 3 out of 10.

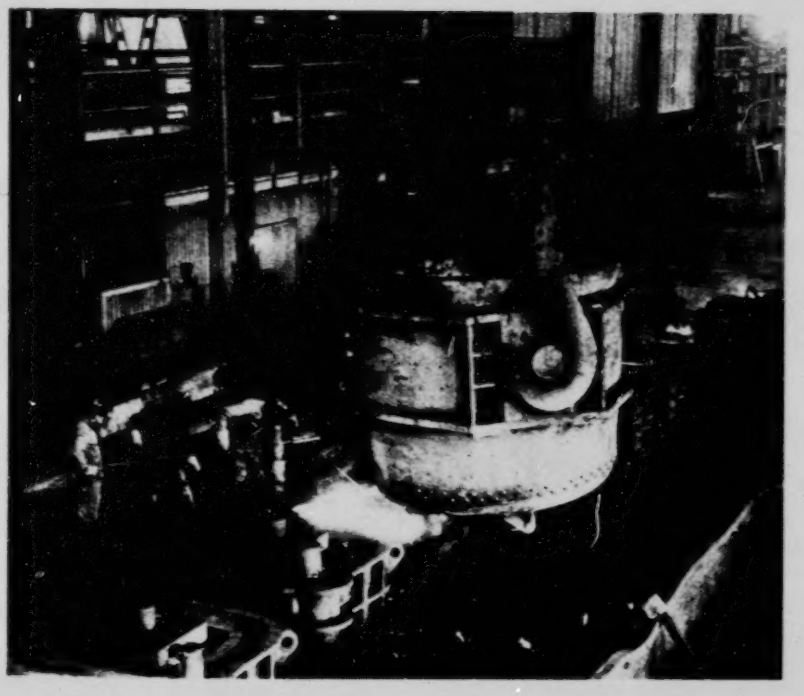
Occupations in the Industry

Workers in the iron and steel industry hold more than 1,000 differ-



ent types of jobs. Many workers are directly engaged in making iron and steel and converting it into semifinished and finished products. Others maintain the vast amount of machinery used in the industry, operate cranes and other equipment that move raw materials and steel products about the plants, or perform other kinds of production jobs. In addition, many workers are needed to do clerical, sales, professional, technical, administrative, and supervisory work.

Men constitute 95 percent of all employees in the industry, and an even higher proportion of the production workers. About two-thirds of the women employed in the industry work in supervisory, administrative, technical, research, and clerical jobs. Women in production departments work in jobs such as assorter and inspector.



Pouring molten iron into molds.

Processing Occupations. The majority of the workers in the industry are employed in the many processing operations involved in converting iron ore into steel and then into semifinished and finished steel products. To provide a better understanding of the types of jobs, brief descriptions of the major steelmaking and finishing operations and of the more important occupations connected with them are given below.

Blast furnaces. The blast furnace, a large steel cylinder lined with heat-resistant brick, is used to reduce iron ore to molten iron. A mixture of ore, coke, and limestone (called a "charge") is fed into the top of the furnace, and hot air blown in the bottom from giant stoves produces intense heat, thus melting the charge.

Molten iron trickles down through the charge and collects in a pool at the bottom of the furnace. At the same time, the intense heat causes the limestone to combine with silica and other impurities in the ore and coke to form "slag", a byproduct that is used for making cement and insulating materials, and other purposes. The slag, too, trickles down through the charge and floats on top of the heavier molten iron. Every 3 or 4 hours, the furnace is cast to remove the molten iron; slag is removed more frequently.

A blast furnace operates continuously, 24 hours a day, 7 days a week, unless it is shut down for repairs or for other reasons. A single furnace may produce up to 7,500 tons of iron in a 24-hour period.

The raw materials used in blast furnaces are stored in a stockhouse below furnace level. Here *stockhouse men* or *stockhouse larrymen* (D.O.T. 919.883) load traveling larry cars with iron ore, coke, and limestone. They weigh these raw materials into various amounts determined by the kind of hot metal desired. The loaded stock cars are emptied into waiting "skip cars," which carry the materials up tracks to the top of the blast furnace, where they are automatically dumped. Other stockhouse men, or *skipmen* (D.O.T. 921.883), stationed on the ground below, control the skip cars through electric and pneumatic controls. *Stove tenders* (D.O.T. 512.782) and their assistants operate the stoves which heat air for the blast furnace. They regulate valves to control the heat of the stoves and the flow of air to the furnace.

The persons responsible for the quantity and quality of iron produced are called *blowers* (D.O.T. 519.132). They direct the operation of one or more blast furnaces, including loading and tapping the furnace and regulating the air blast and furnace heat. Blowers carefully check the metal produced, periodically sending samples of the molten iron and slag to the laboratory where

quality tests are made. *Keepers* (D.O.T. 502.884), under the direction of the blower, are responsible for tapping the furnace. They direct their helpers and *cindermen* or *slaggers* (D.O.T. 519.887) in lining (with special heat-resistant sand) the troughs and runners through which the molten iron and slag are run off into waiting ladles.

Some iron is made into finished products such as automobile engine blocks and plumbing pipes. Most of it, however, is used to make steel. Because steel is stronger than iron and can be hammered and bent without breaking, it can be used for a much larger variety of products.

Steel furnaces. Steel is made by refining iron to remove some of the carbon and impurities and adding scrap steel and alloying agents such as copper and manganese. This is done in several types of furnaces: basic oxygen, open hearth, and electric.

More than half of all domestic steel is made in basic oxygen furnaces (BOF's), and about a third in open hearth furnaces. Both produce similar kinds of steel, but BOF's do the job faster and are expected to replace many of the open hearths now in operation. Electric furnaces primarily are used to produce high quality metals such as tool and stainless steel.

A *melter* (D.O.T. 512.132) is responsible for the quality and quantity of the steel produced in a furnace. The melter makes the steel to the desired specifications by varying the proportions of iron, scrap steel, and limestone in the furnace, and by adding small amounts of other materials such as manganese, silicon, copper or other alloy additives. Those working with open hearth furnaces supervise three grades of helpers—*first* (D.O.T.512.782), *second* (D.O.T. 502.884), and *third* (D.O.T. 519.887). Melters in charge of BOF's supervise *BOF operators* (D.O.T. 512.782). Helpers and operators prepare the furnaces for each batch of steel, regulate furnace temperatures, take samples of molten steel for laboratory tests, direct the adding of various alloying materials, and tap the molten steel from the furnace into a ladle. The BOF operators also regulate the shooting of oxygen through a nozzle to the furnace.

When the batch of steel is ready to be tapped from an open hearth furnace, the furnace crew knocks out a plug in the furnace with a "jet tapper" (small explosive charge fired into the plug) which allows the molten metal to flow into a ladle. The slag floats to the top of the ladle and overflows into a slag pot. The crew taps steel from a BOF by tilting the furnace on its side and pouring out the steel through a nozzle or lip at the top.

The molten steel is made into large bars called "ingots." A *ladle craneman* (D.O.T. 921.883) operates an overhead crane which picks up the ladle of molten steel and moves it over a long row of ingot molds resting on flatbottom cars. The *steel pourer* (D.O.T. 514.884) operates a stopper on the bottom of the ladle or tilts the ladle to let the steel flow into these molds. As soon as the steel has solidified sufficiently, an *ingot stripper* (D.O.T. 921.883) operates an overhead crane, which removes the molds from the ingots.

Rolling and finishing. The three principal methods of shaping steel are

Melter takes sample of molten steel to test quality.

rolling, casting, and forging. About three-fourths of all steel products are shaped by the rolling process. In this method, heated steel ingots are squeezed longer and flatter between two cylinders or "rolls." Before ingots of steel are rolled, they are heated to the temperature specified by the plant's metallurgist. The heating is done in large furnaces called "soaking pits," located in the plant floor. A *heater* (D.O.T. 613.782) controls the soaking pit operation. He directs helpers in heating the ingots to the specified temperature and, with the help of control equipment, determines when they are ready for rolling. A *soaking pit craneman* (D.O.T. 921.883) operates an overhead crane, by means of electrical controls, to lift the ingots from small rail-cars and place them into the soaking pit. When the ingots are hot enough, the heater opens the furnace covers and the craneman removes the ingots and places them on an ingot buggy, which carries them to the first rolling mill, sometimes called a "break down" mill. Here, the ingots are rolled into smaller, more easily handled semifinished shapes called blooms, slabs, and billets. Blooms are generally between 6 and 12 inches wide and 6 and 12 inches thick. Slabs are much wider and thinner than blooms. Billets are the smallest of these three shapes.

The rolling of blooms illustrates the semifinishing process. In the blooming mill, as in other rolling mills, the ingot moves along on a roller conveyor to a machine which resembles a giant clothes wringer. A "two-high" blooming mill has two grooved rolls which revolve in opposite directions. The rolls grip the approaching ingot and pull it between them, squeezing it thinner and longer. When the ingot has made one pass through the rolls, the rolls are reversed, and the ingot is fed back through them. Throughout the rolling operation, the ingot is periodically turned 90 degrees by mechanical devices called "manipulators," and passed between the rolls again so that all sides are rolled. This operation is repeated until the ingot is reduced to a bloom of the desired size. The bloom then is ready to be cut to specified lengths.

A blooming mill *roller* (D.O.T. 613.782), the man in charge of the mill, works in a glass-enclosed control booth, located above or beside the roller line. His duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple. However, the quality of the product and the speed with which the ingot is rolled depends upon his skill. The roller regulates the opening between the rolls after each pass. Long experience and a knowledge of steel characteristics are required for a worker to become a roller. A *manipulator operator* (D.O.T. 613.782) sits in the booth beside the roller and coordinates his controls over the ingot's position with those of the roller.

Upon leaving the rolling mill, the red-hot bloom moves along a conveyor to a place where a *shearman* (D.O.T. 615.782) controls a heavy hydraulic shear which cuts the steel into desired lengths.

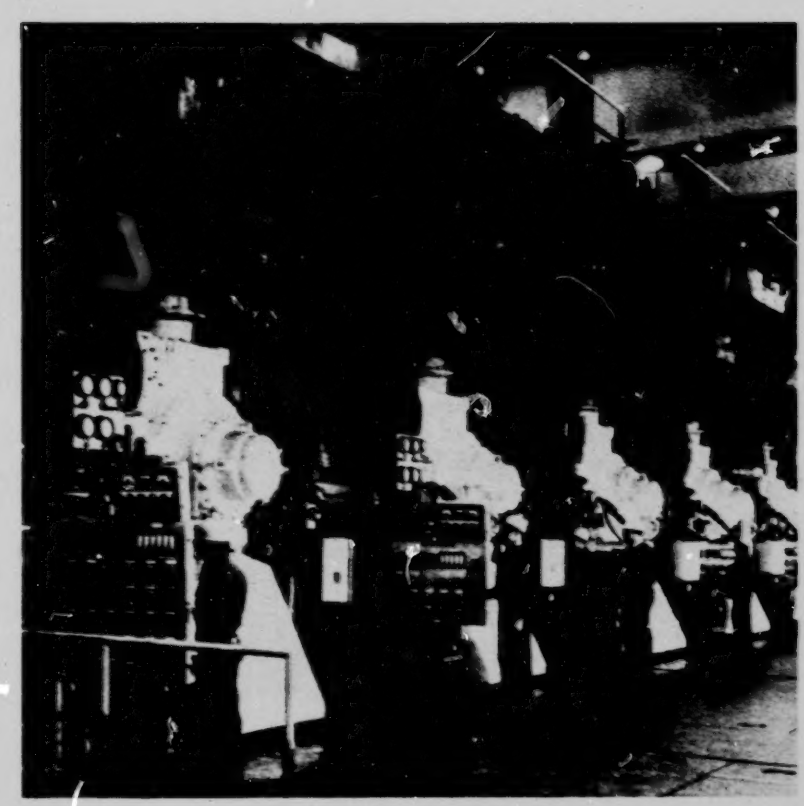
In a blooming mill that has automatic controls, a rolling mill attendant is given a card that has been punched with a series of holes. The holes represent coded directions as to how the ingot is to be rolled. The attendant inserts the card into a card "reader" then presses a button that starts the automatic rolling sequence. When this process is used, the roller's job is shifted from operating the controls to directing and coordinating the rolling process.

Of increasing use in steel shaping is the continuous casting process, which eliminates the necessity of producing large ingots that in turn must be put through huge blooming and slabbing mills. In the continuous casting process, molten steel is poured into a water-cooled mold of the desired product shape, such as slab or billet shape. As the mold is filled, the steel cools and solidifies along the bottom and lower sides, and passes down through a chamber where it is further cooled by a water spray. Pinch rolls control its descent and support its weight, and the molded slab or billet of steel is cut into lengths as it emerges from the rolls.

After the steel is rolled or cast into semifinished shapes, most of it is put through semifinishing operators. Slabs, for example, can be reduced and shaped into plates and sheets. Rods can be reduced to wire, and wire can be processed into nails, fencing, and other end products.

Equipment operator, inspector, and assorter are among the major occupations in finishing operations; women frequently are employed in these jobs. *Wire drawer* (D.O.T. 614.782) and *piercer-machine operator* (D.O.T. 613.885) are examples of equipment operating occupations. The wire drawer controls equipment that pulls a steel rod through a die. The die has a tapered hole, one end of which is smaller than the rod. As the rod passes through the tapered hole, it is made thinner and longer and becomes wire. The piercer-machine operator controls machinery that makes seamless pipe from solid billets of steel. The operator passes a heated billet between two barrel-shaped rolls which spin the billet and force one end of it against a sharp plug or "mandrel." The mandrel smooths the inside wall of the billet and makes the diameter of the hole uniform.

Maintenance, Transportation, and Plant Service Occupations. Large



Operators tend tandem rolling mill.

numbers of workers are required in steel plants to support processing activities. Some maintain and repair machinery and equipment, and others operate the equipment which provides power, steam, and water. Other groups of workers move material and supplies and perform a variety of service operations.

Machinists and machine tool operators make and repair metal parts for production equipment. Diemakers use machine tools to form dies, such as those used to make wire. *Roll turners* (D.O.T. 613.780) use lathes, grinders, and other machine tools to finish the steel rolls used in the rolling mills.

Millwrights overhaul machinery and repair and replace defective parts. Electricians install wiring and fixtures and hook up electrically operated equipment. Electrical repairmen (motor inspectors) keep wiring, motors, switches, and other electrical equipment in good operating condition.

Electronic repairmen install, repair, and adjust the increasing number of electronic devices and systems used in steel manufacturing plants. Typically, this equipment includes communication systems such as closed-circuit television; electronic computing and data recording systems; and measuring, processing, and control devices such as X-ray measuring or inspection equipment.

Bricklayers repair and rebuild the brickwork in furnaces, soaking pits, ladles, and coke ovens, as well as mill buildings and offices. Pipefitters lay out, install, and repair piping that is used to carry the large amounts of liquids and gases used in steelmaking. Boilermakers test, repair, and rebuild heating units, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate trains that transport materials and products in the vast yards of iron and steel plants. Other skilled workers operate the various boilers, turbines, and switchboards in factory powerplants.

Other types of maintenance and service workers include carpenters, oilers, painters, instrument repairmen, scale mechanics, welders, loaders, riggers, janitors, and guards. Many laborers are employed to load and unload materials and do a variety of cleanup jobs.

Administrative, Clerical, and Technical Occupations. Professional, administrative, clerical, and sales workers account for about one-fifth of the industry's total employment. Of these, the majority are clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians make up a substantial proportion of the industry's white-collar employment. Several thousand of these workers perform research and development work to improve existing iron and steel products and processes, and to develop new ones.

Among the technical specialists employed in steelmaking are mechanical engineers, whose principal work is the design, construction, and operation of mill machinery and material handling equipment. Metallurgists and metallurgical engineers work in laboratories and production departments where they have the important task of specifying, controlling, and testing the

quality of the steel during its manufacture. Civil engineers are engaged in the layout, construction, and maintenance of steel plants, and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and supervise the operation of electrical facilities that provide power for steel mill operation.

Chemists work in the laboratories, doing chemical analyses of steel and raw materials. Laboratory technicians do routine testing and assist chemists and engineers. Draftsmen prepare working plans and detailed drawings required in plant construction and maintenance.

Among the employees in administrative, managerial, and supervisory occupations are office managers, labor relations and personnel managers, purchasing agents, plant managers, and industrial engineers. Working with these personnel are several thousand professional workers, including accountants, nurses, lawyers, economists, statisticians, and mathematicians. The industry also employs several thousand sales workers.

(Detailed discussions of professional, technical, mechanical, and other occupations found in the iron and steel industry, as well as in many other industries, are given elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New workers in processing operations usually are hired as unskilled laborers. Openings in higher-rated jobs usually are filled by promoting workers from lower grade jobs. Factors considered when selecting workers for promotion are ability to do the job, physical fitness, and length of service with the company.

Training for processing occupations is done almost entirely on the job. Workers move to operations requiring progressively greater skill as they acquire experience. A craneman, for example, first is taught how to operate relatively simple cranes, and then he advances through several steps to cranes much more difficult to run, such as the hot-metal crane.

To help them advance in their work, many employees take part-time courses in subjects such as chemistry, physics, and metallurgy. In some cases, this training is provided by the steel companies and may be given within the plant. Other workers take evening courses in high schools, trade schools, or universities in their communities or enroll in correspondence courses.

Workers in the various operating units usually advance along fairly well-defined lines of promotion within their departments. Examples of possible lines of advancement in the various operating units are described in the next paragraph.

To become a blast furnace blower, a worker generally starts as a laborer, advancing to cinderman or slagger, keeper's helper, keeper, blower's helper, and finally to blower. In the steel furnace department, a man may begin by doing general cleanup work around the furnace and then advance to third helper, second helper, first helper, and eventually to melter. A possible line of job advancement for a roller in a finishing mill might be pitman, roll hand, manipulator, rougher, and finish roller. Workers may be trained for skilled jobs, such as blower, melter, and roller, which are among the highest rated steelmaking jobs, in a minimum of 4 or 5 years, but usually they have to wait much longer before openings occur.

Although many maintenance workers start as helpers and pick up their skills from experienced workers, apprenticeship is the best way to learn a maintenance trade. Apprenticeship programs usually are of 3 or 4 years' duration and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects usually is given, either in the plant or in local vocational schools.

Steelmaking companies have different qualifications for apprentice applicants. Generally, employers require applicants to have the equivalent of a high school or vocational school education. In most cases, the minimum age for applicants is 18 years. Some companies give aptitude and other types of tests to applicants to determine their suitability for the trades. Apprentices generally are chosen from among qualified young workers already employed in the plant.

The minimum requirement for engineering and scientific jobs is usually a bachelor's degree with an appropriate major. Practically all the larger companies have formal training programs for college-trained technical workers. In these programs, the trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before they are assigned to a particular department. In other companies, the newly hired scientist or engineer is assigned directly to a specific research, operating, maintenance, administrative, or sales unit. Engineering graduates frequently are hired for sales work and many of the executives in the industry have engineering backgrounds. Engineering graduates, as well as graduates of business administration and liberal arts colleges, are employed in jobs in sales, accounting, and labor-management relations, as well as in managerial positions.

Completion of a business course in high school, junior college, or business school usually is preferred for

entry into most of the office occupations. Office jobs requiring special knowledge of the steel industry generally are filled by promoting personnel already employed in the industry.

Employment Outlook

Employment in the iron and steel industry is not expected to increase significantly in the long run (1972-85). Nevertheless, many workers will be hired to replace those who retire, die, or transfer to other fields. The total number hired may fluctuate from year to year, because the industry is sensitive to changes in business conditions and defense needs.

Production of iron and steel is expected to increase moderately as population and business growth create a need for more automobiles, household appliances, industrial machinery, and other products that require large amounts of these metals. Because of laborsaving technology, however, employment is not expected to keep pace with increases in production. Open hearth furnaces, for example, will continue to be replaced with more efficient basic oxygen furnaces, thus increasing the amount of steel produced per worker. The greater use of computers to control plant equipment and process business records also will increase efficiency.

Employment trends will differ among occupations. The number of engineers, metallurgists, laboratory technicians, and other technical workers will increase as a result of the industry's expanding research and development programs. Employment of computer programers and operators also will increase. Employment in processing occupations, on the other hand, is expected to decline slightly as more efficient plant machinery and equipment is introduced.

Earnings and Working Conditions

Earnings of production workers in iron and steelmaking are among the highest in manufacturing. In 1972, they averaged $5.04 an hour, while production workers in manufacturing as a whole averaged $3.81.

Agreements between most steel companies and the United Steelworkers of America include some of the most liberal benefits in industry. Most workers receive vacation pay ranging from 1 to 4 weeks, depending on length of service. A worker in the top 50 percent of a seniority list receives a 13-week vacation every 5 years; the remaining workers receive 3 extra weeks vacation once in a 5-year period. Professional and executive personnel in some companies receive similar benefits.

Workers may retire on company-paid pensions after 30 years of service, regardless of age. Employees having 2 years or more of service are eligible to receive supplemental unemployment benefits for up to 52 weeks. Some other benefits are health and life insurance, and education and scholarship assistance.

Working conditions vary by department. Maintenance shops generally are clean and cool. Rolling mills and furnaces are hot and noisy. Some plants have developed methods to reduce job discomfort. The use of remote control, for example, enables employees to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the men sit while operating mechanical equipment, such as cranes, are air-conditioned. Because certain processes are operated continuously, many employees are on night shifts or work on weekends.

The iron and steel industry has been a leader in the development of safety programs for workers, emphasizing the use of protective clothing and devices on machines to prevent accidents. In recent years, steel plants had an average injury frequency rate (injuries per million hours of work) that was less than half the rate of all manufacturing.

Most plant workers in the iron and steel industry are members of the United Steelworkers of America.

Basic straight-time hourly earnings[1] of workers in selected occupations in basic iron and steel establishments, mid-1972

	Hourly earnings
Blast furnaces:	
Larrymen	$4.26
Stock unloaders	3.70
Basic oxygen furnaces:	
Steel pourers	4.83
Furnace operators	5.30–5.58
Open hearth furnaces:	
Charging machine operators	4.83
First helpers	5.58
Bloom, slab, and billet mills:	
Soaking pit cranemen	4.73
Manipulators	4.54
Continuous hot-strip mills:	
Chargers	3.89
Coilers	4.36
Maintenance:	
Bricklayers	4.92
Millwrights	4.83

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts. Incentive payments, such as those resulting from piecework or production bonus systems and cost-of-living allowances are included.

Sources of Additional Information

Additional information about careers in the iron and steel industry may be obtained from the following organizations:

American Iron and Steel Institute, 1000 16th St. NW., Washington, D.C. 20036.

United Steelworkers of America, 1500 Commonwealth Building, Pittsburg, Pa. 15222.

OCCUPATIONS IN LOGGING AND LUMBER MILLS

Young people who have a high school education and a love for the outdoors and wildlife may find rewarding careers in the logging and lumber industry. Logging camps and sawmills provide many job opportunities in the South and Pacific Northwest, the Nation's major timber-producing regions. Because the building and furnishing of homes, hospitals, schools, stores, and most other structures depend upon lumber and wood products, thousands of job openings will be available each year through the mid-1980's.

Nature and Location of the Industry

In 1972, nearly 70,000 wage and salary workers were employed in logging to help harvest trees and remove them from forests. A much larger number—about 217,000—worked in sawmills and planing mills where logs are converted into lumber. In addition, more than 50,000 workers were self-employed, most of them in logging. Because of the heavy physical labor involved, about 5 percent of the industry's employees were women, most of whom worked in clerical occupations.

This statement deals with activities and jobs involved in cutting and removing timber from forests, and in the processing of logs into rough and finished lumber. It excludes the manufacture of paper, plywood, veneer, and other wood products such as furniture and boxes. Occupations in paper manufacturing are discussed in a separate statement elsewhere in the *Handbook*.

Lumber production has followed the same basic process for many years. A stand of timber is harvested in the forest, moved to a central location or "landing" accessible to transportation, and then carried by truck or rail to a mill for processing. Logging crews typically consist of from 5 to 15 workers. Several crews, each working at a different location, may be needed to supply logs for a single mill. The crew moves from time to time through the forest as one area after another is harvested. Years ago these workers lived in camps close to the cutting site. With better roads, most of them can now live at home and commute to work.

In the sawmill, logs are debarked, rough-sawn into various widths and lengths, and then seasoned (dried) so the wood will not warp. A small amount of rough lumber is sold without further processing, but the rest must be sent to a planing mill before it goes to market. In this mill, rough boards are finished to give them a smooth surface. Boards also are made into flooring, siding, moulding and other forms of building trim. Since logs cost more to ship than lumber, sawmills usually are located near tree harvesting areas. Some of these mills are small, porta-

Sawmill deckmen roll log to carrier.

ble operations that can be moved about from week to week as the harvest progresses, but the large ones are permanent. Planing mills may be near sawmills or hundreds of miles away. About three-fourths of all mills employ fewer than 20 workers, but some have more than 100.

Although some logging and lumber mill workers are employed in nearly every State, the following 7 account for about half of the industry's employment: Oregon, Washington, California, Alabama, North Carolina, Arkansas, and Georgia.

Logging. Before a stand of timber is harvested, a professionally trained *forester* (D.O.T. 040.081) decides which trees to cut. Foresters also map the cutting areas, plan and supervise the cutting, and plant seedlings to replace the trees that were removed. *Timber cruisers* (D.O.T. 449.287) estimate the volume and grade of standing timber and help foresters make maps. Heavy equipment operators build access roads and trails to the cutting and loading areas so that they can be reached by logging crews.

The initial harvesting task—"falling and bucking"—is the process of cutting the tree to the ground and further cutting (bucking) it into logs for easier handling. *Fallers* (D.O.T. 940.884), working singly or in pairs, cut down trees marked by the forester. Using a chain saw, the faller first makes a wedge shaped cut on the side of the tree toward which he wants it to fall. Next, he makes a "backcut" on the opposite side of the tree. As the tree starts to fall, he quickly dislodges the saw so that it will not be damaged and scrambles away from the stump. Expert fallers can usually drop a tree in the exact spot where they want it, making sure other trees are not injured in the process. As soon as the tree is down, *buckers* (D.O.T. 940.884) use chain saws to remove the limbs and saw the trunk into logs.

The next task—"skidding"—is a method of removing logs from the cutting area. A choker (steel cable) is noosed around the log by *chokermen* (D.O.T. 942.887) and then attached to a tractor which drags the log to the landing. A *rigging slinger* (D.O.T. 942.884) supervises and assists chokersetters and tractor drivers. In rough terrain where logs must be moved up or down steep slopes or across ravines, the "high-lead" method is used instead of tractor skidding. This method is somewhat like a fisherman's rod and reel. Steel cables run from a diesel-powered winch (reel) through pulleys at the top of a large steel tower (rod) and down to the cutting area which may be hundreds of feet away from the tower. Chokersetters noose the end of the cable around a log and a *yarder engineer* (D.O.T. 942.782) operates the winch to pull the log into the landing. Experiments are now being made with heavy duty helicopters. Hovering above a logging site, the helicopters can lift and move logs weighing several tons.

After logs reach the landing, they are loaded on a truck trailer and hauled to a mill. A *loader engineer* (D.O.T. 921.883) operates a machine that picks up logs and places them on the trailer. A *second loader* (D.O.T. 949.884) directs the positioning of logs on the trailer. Although trucks usually are used, logs are sometimes carried by railroad cars.

Sawmills and Planing Mills. At the sawmill incoming logs are stacked on the ground (cold decking) or dumped into a pond to await cutting. Water storage protects the wood from shrinking, insect damage, and fire. Cold-decking, on the other hand, permits greater storage volume per acre, and some hardwoods such as oak must be stored this way because they will sink in water. *Scalers* (D.O.T. 941.488) measure logs and look for defects, such as knots and splits, to estimate the amount and quality of lumber available. *Pondmen* (D.O.T. 921.886) wearing spiked boots walk about on logs in the pond, and use long poles to sort the logs so that all of one kind or size go into the mill together.

A *bull-chain operator* (D.O.T. 921.885) controls a conveyor that pulls logs up a chute into the sawmill. A *barkerman* (D.O.T. 533.782) operates machinery to remove bark and foreign matter that could damage saws. One kind of machine has rough metal bars or knives that rub or chip the bark away. Another kind tears it off with the high pressure force of water. The removed bark may be processed into garden mulch.

As a log enters the sawing area, a *deckman* (D.O.T. 667.887) rolls it onto a platform called a "carriage," and a *block setter* (D.O.T. 667.885) aligns the log and locks it into position. The carriage, which moves back and forth on rails, carries the log into the teeth of a large bandsaw, and each time it passes the saw a board is sliced off. This operation is controlled by a *head sawyer* (D.O.T. 667.782), who is one of the most experienced workers in the mill. The quantity and quality of lumber obtained from logs depends largely on his skill and knowledge.

After leaving the carriage, the lumber moves to an edger saw, consisting of two or more circular blades. Operated by an *edgerman* (D.O.T. 667.782), the edging machinery cuts the lumber to the desired width. For example, the production run may be cutting boards to a 4 in. width. Next, a *trimmer saw operator* (D.O.T. 667.782), using a series of circular cross-cut saws, cuts the lumber to

various lengths, such as 8, 10, or 12 feet.

When all sawing is completed, a conveyor system moves the rough lumber into a sorting shed, where *graders* (D.O.T. 669.587) examine each board carefully and determine its grade. After grading, *sorters* (D.O.T. 922.887) pull and stack boards according to type, grade, and dimension.

At this stage, the lumber is still green and must be seasoned so that it will not warp. It may be stacked outdoors where the sun and wind will remove the moisture. More frequently, however, it is placed in a specially heated building (dry-kiln). *Dry-kiln operators* (D.O.T. 563.381) control temperature, humidity, and ventilation in kilns. They also direct workers who stack lumber in kilns and remove it after drying.

Some seasoned lumber is ready for use without further processing, primarily in the construction industry. The remainder must pass through a mill before being shipped to market. In this mill, the rough dried lumber is run through a set of rotating knives controlled by a *planer operator* (D.O.T. 665.782). Some knife heads produce smooth surfaces, while others tongue-and-groove the boards for flooring, siding, or paneling. Similarly, a wide variety of moulding or other building trim may be cut. The dressed or finished lumber is usually graded again before storage or shipment by a *planer mill grader* (D.O.T. 669.587).

In addition to occupations described in the logging and milling processes, many other occupations require a broad range of training and skills. Maintenance mechanics install and repair saws and related machinery. Saw filers sharpen and repair saws, and electricians maintain and repair wiring, motors, and other electrical equipment. Truck drivers transport logs to the mills and deliver the finished lumber products to wholesalers.

Many workers are employed in clerical, sales, and administrative occupations. For example, many firms employ office managers, purchasing agents, personnel managers, salesmen, office clerks, stenographers and typists, bookkeepers, and business machine operators. Also, the industry employs professional and technical workers, such as civil and industrial engineers, draftsmen and surveyors, and accountants. (Detailed discussion of professional, technical, and mechanical occupations, found not only in logging and milling but in other industries as well, are given elsewhere in the *Handbook* in sections covering individual occupations.)

Training, Other Qualifications, and Advancement

Most loggers and mill hands get their first jobs without previous training. Employers prefer high school graduates, but applicants with less education frequently are hired. Entry level jobs usually can be learned in a few weeks by observing and helping experienced workers. A beginner on a logging crew may start by helping chokermen or buckers. In the mill, a beginner may be assigned to a labor pool to do odd jobs, such as stacking and sorting lumber. As workers gain experience, and as vacancies occur, they can advance to higher paying jobs. A chokerman, for example, who has an aptitude for operating machinery may become a truck or tractor driver, or a yarder engineer. Mill hands also can learn various kinds of machine operating jobs, such as bull-chain operator and edgerman.

Mechanics, electricians, and others who repair and maintain the industry's equipment are trained on the job under the guidance of supervisors and experienced workers. In some firms, this training is supplemented by classroom instruction. Maintenance trainees frequently are selected from workers already employed in mills or logging crews. Many firms, however, will hire inexperienced young people who have mechanical aptitude. Generally, it takes a trainee 3 to 4 years to qualify as a skilled craftsmen in one of the maintenance jobs.

Workers who have leadership ability and years of experience can advance to supervisory positions in mills and logging crews. As in other industries, however, opportunities for promotion are limited because relatively few of these positions exist.

Loggers and mill workers must be in good physical condition. Although modern equipment has reduced some of the heavy labor, stamina and agility are still important qualifications, particularly for loggers. Because of the danger involved in operating and working around heavy machinery, workers should be alert and well coordinated.

A bachelor's degree usually is the minimum educational requirement for forester, engineer, accountant, and other professional occupations. Completion of commercial courses in high school or business school is usually adequate for entry into clerical occupations, such as secretary, typist, and bookkeeper.

Employment Outlook

Employment in logging and lumber mills is expected to decline moderately through the mid-1980's despite increases in wood production to meet the Nation's population and industrial growth. Nevertheless, the industry will need several thousand new workers each year to replace those who retire, die, or leave the industry for other reasons.

Laborsaving machinery will make it possible for logging contractors and mills to harvest and process more lumber with fewer employees. More workers, however, will be needed in some occupations. Additional mechanics, for example, will be needed to maintain the growing stock of logging equipment, trucks, and mill machinery. More foresters will find jobs in this industry as forest replanting and conservation programs receive greater attention. Engineers will be in greater demand as the industry's production methods become more complex. Most job openings, however, will be for logging crewmen and mill hands; because these workers make up a very large proportion of the industry's total employment, replacement needs are high.

Reduction in the size of logging crews is not likely, but improved equipment will speed-up the harvesting operations, thus reducing the number of crews. Sawmills and planing mills may reduce employment requirements by installing new machinery and improving plant layouts. In the kiln area, for example, a stacking machine operated by 2 or 3 men can replace 6 men who stack by hand.

Earnings and Working Conditions

In 1972, production workers in logging averaged $4.11 an hour; those in sawmills and planing mills averaged $3.20. In comparison, production workers in manufacturing industries as a whole averaged $3.81 an hour.

Logging	*Hourly Rates*	
	South	*West Coast*
Deckmen	$2.00	$3.90
Pondmen	2.30	3.90
Sorters	2.00	3.90
Trimmermen	2.10	4.10
Chokermen	2.15	4.25
Block setters	2.25	4.35
Edgermen	2.15	4.40
Lumber stackers	2.00	4.40
Truckdrivers	2.25	4.45
Planer operators	2.90	4.65
Graders, planed lumber	2.40	4.70
Tractor drivers, skidding	2.40	5.00
Head-saw operators, circular saw	3.00	5.35
Head-saw operators, band saw	4.00	5.80
Fallers and buckers, power	2.50	7.10

Wage rates vary considerably by occupation, size of firm, machines and equipment used and, above all, by geographic area. Average hourly rates for selected occupations in West Coast and Southern logging operations and mills in 1972 are shown in the accompanying tabulation.

Most logging jobs are outdoors. The forest may be wet, muddy, and hot, with annoying insects during the summer; conversely, working conditions may be difficult and time lost because of snow, sleet, and low temperature during the winter. Sawmills and planing mills may be noisy and dusty, and uncomfortably warm during the summer. Moreover, work at logging sites and in mills is more hazardous than in most manufacturing plants. For many persons, however, the opportunity to work and live in forest regions away from crowded cities more than offsets these disadvantages.

The major unions in this industry are the International Woodworkers of America and the United Brotherhood of Carpenters and Joiners of America, both AFL-CIO affiliates. A recent survey showed that three-fifths of the industry's production workers on the West Coast were covered by union-management contracts. On the other hand, only one-sixth of those in the South were covered.

Sources of Additional Information

Further information about job opportunities and working conditions in this industry is available from the following organizations:

American Pulpwood Association, 605 Third Ave., New York, N.Y. 10016.

International Woodworkers of America, 1622 N. Lombard St., Portland, Oreg. 97217.

National Forest Products Association, 1619 Mass. Ave. NW., Washington, D.C. 20036.

MOTOR VEHICLE AND EQUIPMENT MANUFACTURING OCCUPATIONS

Few products are as important to everyday life as the automobiles, trucks, buses, and other vehicles built by the motor vehicle and equipment manufacturing industry (or automobile industry). In 1972, 4 out of 5 families owned at least one car, and nearly 1 family out of 3 owned two or more. A total of about 118 million cars, trucks, and buses traveled the Nation's streets and highways.

The widespread use of motor vehicles has made significant contributions to the Nation's economy. The automobile industry (SIC 371) employs more workers than any other single manufacturing industry. Moreover, it is a major consumer of steel, rubber, plate glass, and other basic materials. Many businesses, including repair shops, gas stations, highway construction, and truck and bus transportation facilities, have been created because of motor vehicles.

To build the more than 11 million vehicles produced in 1972, the automobile industry employed 860,000 workers. In addition to workers discussed in this chapter, thousands of persons work in other industries that produce automobile glass, automotive stampings, lighting systems, storage batteries, tires, and many other components.

Like other large industries, the automobile industry employs men and women with widely different education and training. Job requirements vary from a college degree for engineers and other professional and technical workers, to a few hours of on-the-job training for some assemblers, materials handlers, and custodians.

Most of the automobile industry's employees work in factory (plant) jobs. Plant occupations range from the highly skilled tool and die maker, millwright, and electrician, to the unskilled machine tender, power truck operator, and custodian. A large number of people also work in office and administrative jobs as clerks, business machine operators, stenographers, purchasing agents, and personnel specialists.

Nature and Location of the Industry

The automobile industry is able to produce millions of vehicles because of mass production of standardized parts and assembly line manufacturing. Parts plants make thousands of interchangeable parts. At the assembly plants workers put these parts together to build a complete vehicle. New cars are driven off the assembly line at the rate of about one a minute.

The industry has about 2,800 plants, ranging from small parts plants with only a few workers to huge assembly plants that employ several thousand. About 85 percent of the industry's employees work in plants with 500 or more workers.

About 44 percent of all automobile industry employees work in plants that assemble complete vehicles. Another 43 percent work in parts and accessories plants that produce brakes, transmissions, and other components. The remainder work in plants that make bodies and truck trailers.

Over two-thirds of the automobile industry's employees work in the Great Lakes region, including Michigan, Ohio, Indiana, Illinois, Wisconsin, and western New York. Michigan alone has almost 40 percent of the total, with half of these workers in the Detroit metropolitan area. Other important automobile industry centers in the Great Lakes area are Flint and Lansing, Michigan; Cleveland and Warren, Ohio; Indianapolis and Ft. Wayne, Indiana; Buffalo, New York; and Chicago, Illinois.

Major automobile manufacturing centers are also found in other parts of the country, including Los Angeles, San Francisco, Kansas City, St. Louis, Atlanta, and Philadelphia.

How Automobiles are Made

There are three stages in producing an automobile: designing, engineering, and testing; production of parts and subassemblies; and final assembly. (Although the rest of this statement discusses only automobiles, the same information applies to trucks, buses, and other motor vehicles.)

Designing, Engineering, and Testing. About 2 to 3 years of designing, engineering, and testing precede the actual production of a new car.

First, executives decide what kind of car to produce—a sports car, compact, or luxury car—and approve basic specifications for the car's size and cost. Stylists design the car's body and interior. From the stylists' sketches and drawings, skilled model makers make scale and full-size clay and fiberglass models of the car. The models are used to refine the styling, to evaluate safety features, and finally to make master dies for produc-

ing the car.

Engineers design the car's engine, transmission, suspension, and other parts. Their designs must meet safety and pollution control standards, as well as pass cost and performance tests. They work with physicists, chemists, metallurgists and other scientists to research and develop new parts, stronger and lighter metal alloys, ways to use plastic and fiberglass, and thousands of other improvements. Engineers also work with draftsmen who draw up blueprints and specifications.

Each new design and improvement is thoroughly tested in the laboratory and on the road. Engines are run thousands of miles under nearly all driving conditions. Safety features are tested in the laboratory and in actual crashes. Components that fail must be redesigned before the car can be produced.

Production of Parts. Once the car is finally designed and tested, the thousands of parts that are needed to assemble complete vehicles must be produced. Parts are made from a variety of materials, including steel, copper, aluminum, glass, rubber, plastic and fabric.

Several different methods are used to make metal parts. The casting process is used for bulky parts such as engine blocks. Axles and other parts that must withstand great stress are forged. Body panels are stamped out of sheet metal by huge presses. Most rough cast, forged, and some stamped parts are then machined to exact dimensions. Some parts are made entirely by machine. These metalworking processes are explained more fully under plant occupations.

Other parts are produced by a variety of manufacturing processes. Plastic and glass parts are molded and cut, seat cushions are sewn, and many parts are painted. Parts are also assembled into units or "subassemblies", such as complete transmissions.

Throughout production many inspections and tests are made to insure that the assembled car will meet quality and safety standards.

Final Assembly. After many months of designing, testing, and producing parts, the car is finally assembled. A conveyor carries the chassis along the assembly line, workers attach the parts and subassemblies in the right order. Axles are attached; the engine and transmission are mounted; body panels are welded together, painted, and joined to the chassis; instrument panels and seats are installed. Near the end of the line, hubcaps, mirrors, and other finishing touches are added. Gasoline is pumped into the fuel tank, headlights and wheels are aligned, and the car is inspected and driven off the line. The whole final assembly process may take as little as 90 minutes.

Assembling hundreds of cars a day requires expert timing and coordination. Parts and subassemblies are delivered according to production schedules arranged months in advance. They are fed continually to workers from storage areas along the assembly line. Instructions for the color and special equipment for each car are transmitted along the line. This system allows cars of different colors and types to follow each other on the assembly line—a blue sedan may follow a red station wagon. Inspections are made at many assembly stations to make sure the car is put together correctly.

Engineers use mannikin to plan auto interior.

Occupations in the Industry

The automobile industry employs

workers in hundreds of occupations. Semiskilled plant workers, including assemblers and inspectors, make up about one half of all employees. An additional one-quarter are foremen, machinists, tool and die makers, mechanics, and other skilled craftsmen. Clerical workers make up another one-tenth of the total. The rest are professionals, technicians, sales workers, managers, guards, and unskilled workers.

About 9 percent of the industry's employees are women. About half of them are assemblers, inspectors, and other production workers. The rest are in clerical and other office jobs, including research and technical jobs.

Some of the important occupations are described briefly below. Detailed discussions of many of the professional, technical, craft, and plant jobs may be found elsewhere in the *Handbook*.

Professional and Technical Occupations. The modern automobile is the product of the research, design, and development work of thousands of engineers, chemists, draftsmen, and other professional and technical workers.

Nearly 30,000 engineers worked in the automobile industry in 1972. Most of them were mechanical, electrical or industrial engineers. Mechanical engineers design improvements for engines, transmissions, and other working parts. Electrical engineers design the car's electrical system, especially the ignition system and accessories. Industrial engineers concentrate on plant layout, work standards, scheduling, and other production problems. The industry also employs metallurgical, civil, chemical, and ceramic engineers.

The industry employed over 3,000 mathematicians, physicists, chemists, and other physical scientists in 1972. Most of them work on research and development projects such as finding ways to reduce air pollution and studying the behavior of metals under certain conditions. Mathematicians and statisticians design quality control systems and work with research scientists and engineers. Some scientists supervise technical phases of production. Metallurgists, for example, supervise melting and heating operations in the casting and forging departments.

Draftsmen are the largest group of technical workers. They work closely with engineers and stylists to draft blueprints and specifications for each part of the car. Engineering aids, laboratory assistants, and thousands of other technicians also assist engineers and scientists.

Administrative, Clerical, and Related Occupations. Executives decide what kind of vehicles to produce, what prices to charge, where to build plants, and whether to manufacture or buy certain parts. They are assisted by lawyers, market analysts, economists, statisticians, industrial relations experts and other professionals, who may also supervise plant or office staffs. Purchasing agents, personnel managers, and other administrative workers direct special phases of the company's business.

Secretaries, bookkeepers, shipping clerks, keypunch and business machine operators, typists, and other clerical employees work in the industry's plants and offices.

Plant Occupations. About three-fourths of the automobile industry's employees work in the plant. Most of them make parts or work on the assembly line. Others service and repair machinery and equipment.

Foundry Occupations. Engine blocks and many other parts are "cast" or molded from melted metal. Patternmakers, coremakers, and machine molders make sand molds which have a hollow space inside in the shape of the part. Workers called melters and pourers melt the metal in electric furnaces or cupolas, and pour it into the mold. After it cools and hardens into the shape of the part, shakeout men remove the casting from the mold.

Forging Occupations. Axles, driveshafts, and other forged parts are made by pounding metal into dies. Workers called heaters heat the metal in a furnace and place it in a forging die. Hammermen then use a drophammer to pound the metal into the shape of the die. Other forge shop workers clean, finish, heat-treat, and inspect forged parts.

Machining and other Metalworking Occupations. Most rough cast, forged, and some stamped parts must be machined to exact dimensions before they can be used. Machine tool operators, representing one of the industry's largest metal working occupations, run machine tools that cut or grind away excess metal from rough parts. Most operators use only one kind of machine tool and are called lathe operators, milling machine operators or some other special title. Operators on some machines make simple tool changes and gauge machined areas of the parts.

Some machine tools are automatic and can be linked together to do a series of machining operations. A rough engine block, for example, can be moved through hundreds of automatic drilling, cutting, and grinding operations with little or no manual labor. Some of the inspection is also automatic. Workers must monitor a control panel to spot interruptions and breakdowns.

Assembly Occupations. (D.O.T. 806.887) The largest group of workers in the automobile industry

are the *assemblers*. They put together small parts to make subassemblies, and put subassemblies together to build a complete vehicle. Each assembler has a job to do as the vehicle passes his work station. For example, one worker mounts a tire and the next worker tightens the nuts with a power wrench. Most assembly jobs are repetitive and require limited skills. However, they do require good coordination, and may be strenuous.

Finishing Occupations. "Finishing" includes painting, polishing, upholstering, and other operations that protect the car's surface and add to the car's comfort and appearance. *Electroplaters* (D.O.T. 500.885) coat bumpers, grills, hubcaps, and trim with chrome. *Metal finishers* (D.O.T. 705.884) file and polish rough metal surfaces in preparation for painting. *Sprayers* (D.O.T. 741.887) apply primers and paint with power spray guns. *Polishers* (D.O.T. 705.884) polish finished surfaces by hand or with a power buffing wheel.

Several different kinds of workers combine their skills to make the car's upholstery. Working from a pattern, *cutters* (D.O.T. 781.884) cut fabric or leather with hand or electric shears. *Sewing machine operators* (D.O.T. 787.782) sew the pieces together into seat covers or headliners. *Cushion builders* (D.O.T. 780.884) fasten springs, padding, and foam rubber to the seats and other upholstered areas and install the covers.

Inspection Occupations. (D.O.T. 806.281, .283, .381, .382, .387, .684, and .687). Throughout the manufacture and assembly of a new car, inspectors inspect certain parts for defective materials and workmanship. They inspect raw materials, examine parts during manufacturing, check the quality and uniformity of subassemblies, and test drive the new car. Inspectors need various skills, depending on the part of process they inspect. Many of them use micrometers, gauges, testing instruments, and read blueprints and specifications.

Other Plant Occupations. Many other workers help keep the plant operating by delivering materials and parts, repairing equipment, and cleaning and guarding the plant.

Assembly line production requires an elaborate materials handling and delivery system. Materials handlers load and unload raw materials and parts from trucks, ships, and railroad cars. Overhead crane operators move heavy machinery and raw steel. Power truck operators move parts and materials about the plant. Checkers, stock chasers, and stock clerks make sure parts and tools are delivered to the assembly line at the right time. They receive and distribute materials and keep records of shipments.

A large staff of workers set up the

Inspector uses gauges to check engine parts.

plant's equipment and keep it in good condition. Skilled maintenance mechanics and electricians service and repair complex mechanical hydraulic, electrical, and electronic equipment. Millwrights move and install heavy machinery. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Carpenters, stationary engineers, and sheet metal workers also work in automobile plants.

The industry also employs many protective and custodial workers, including guards, gatemen, janitors, and porters.

Training, Other Qualifications, and Advancement

Engineers and scientists must have at least a bachelor's degree with an appropriate major. Advanced degrees or specialized experience are sometimes required for research and development jobs. About a dozen colleges offer undergraduate or graduate courses in automotive engineering, and many companies have training programs in automotive specialties for engineers and scientists. Most companies also offer grants, loans, or tuition refund plans to their employees for advanced study. Engineers and scientists may become supervisors of research or production units, and sometimes enter administrative or executive positions.

Most automotive stylists are graduates of art institutes or have bachelor's degrees in industrial design. Stylists should have a background in practical applications, such as model-building, as well as in design theory and techniques.

Most engineering aids, laboratory assistants, draftsmen and other technicians in the automobile industry are graduates of technical institutes or junior colleges. Others are trained on the job, at company schools, or at company expense at local technical schools or junior colleges. Technicians sometimes advance to engineering jobs through experience and study toward an engineering degree.

Although a college education is not always required, administrative jobs are usually filled by men and women with degrees in business administration, engineering, marketing, accounting, industrial relations, and similar fields. Some companies offer advanced training in these specialties.

For semiskilled jobs, the industry seeks people who can do routine work at a steady pace. Most assembly jobs can be learned in a few hours, and the less skilled machine operating jobs in a few weeks. Plant workers should be in good health and have good coordination and ability to do mechanical work.

Tool and die makers, patternmakers, electricians, and some other craftsmen in the automobile industry need at least 4 years of training. Although many workers learn their skills by working with experienced craftsmen, apprenticeship training is the best way to learn a skilled trade. Automobile manufacturers, working with labor unions, offer apprenticeships in many crafts.

Applicants for apprenticeship usually must be high school, trade, or vocational school graduates, or have equivalent training. Training should include mathematics, science, mechanical drawing, and shop courses. Apprentices must pass physical examinations, mechanical aptitude tests and other qualifying tests.

Apprenticeship includes both classroom and on-the-job instruction. Shop math, blueprint reading, shop theory, and such special subjects as electronics and hydraulics are studied in the classroom. In the shop apprentices learn the techniques of their trade and how to use tools and machinery.

Foremen usually are selected from employees already employed in the firm, especially if they have apprenticeship training and considerable experience. Newly promoted foremen usually go through a special training program.

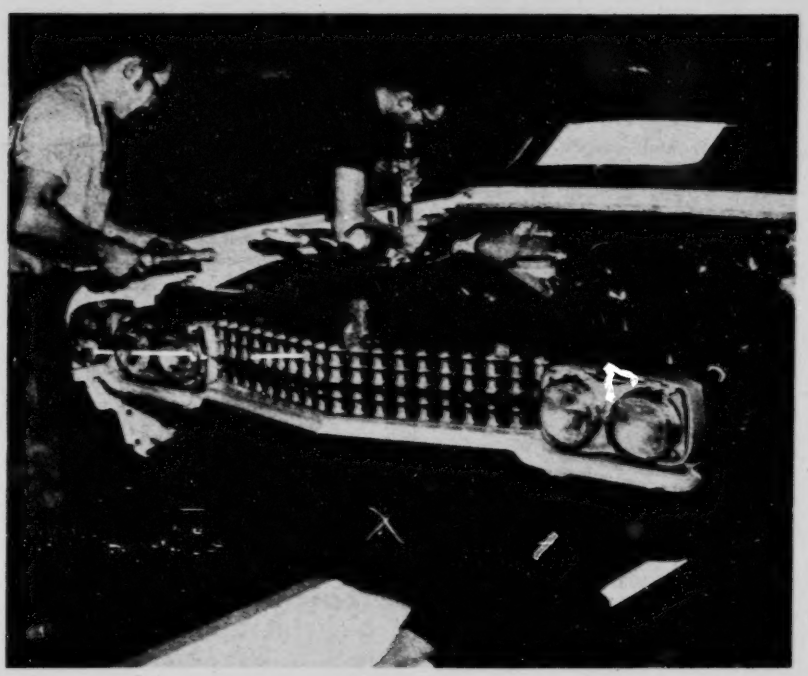
Training for many of the production, clerical and technical jobs in the automobile industry is available under the Manpower Development and Training Act. These training programs for unemployed and underemployed workers may last up to a year. Trainees in some programs may need further on-the-job or apprenticeship training.

Employment Outlook

Employment in the automobile industry is not expected to increase significantly in the long run (1972-1985). Nevertheless, many workers will be hired to replace those who retire, die, or transfer to other industries. The total number hired will fluctuate from year to year because the industry is sensitive to changes in general business conditions, consumer preferences, availability of credit, and defense activity.

The demand for motor vehicles will grow substantially during the next decade as population and income increase. More automobiles will be needed as families move from the cities to the suburbs, and to replace cars that wear out. More trucks and buses will be needed to carry freight and passengers.

Because of labor-saving technology, however, employment in the industry will not keep pace with production. Automobile companies will use more automated and computerized equipment for machining, assembling, and inspecting. A recent example is the versatile "industrial robot" which can be programmed to weld body panels, feed parts into machine tools, and do a variety of other tasks. More efficient processes, such as electron beam welding and electrical discharge machining will be more widely used. Also, new or



Assemblers attach front-end subassembly.

modernized plants will have the latest conveyor equipment for moving parts and materials.

Many other changes will also reduce the amount of labor needed to produce a vehicle. For example, more parts will be made of plastics, which can be molded in one piece and need less machining and finishing than do metal parts.

Some of the industry's increased efficiency, however, will be offset by other developments. More workers will be needed to design, test, and build additional safety and exhaust control equipment. Although the variety of models built is declining slowly, more cars will have air-conditioning, power brakes, and other special equipment.

Changes in the kinds of vehicles built and how they are produced will affect the type as well as the number of workers employed in the automobile industry. More engineers, scientists, technicians, and other professionals will be employed to meet the industry's research and development needs, especially to design new engines, exhaust systems, and safety equipment. The use of computers will increase the need for systems analysts and programmers, but will limit employment growth in many clerical occupations.

The employment of skilled workers, as a group, may decline slightly, mainly because fewer machinists and welders will be needed as more efficient processes are introduced. Some skilled occupations will grow, including electricians, millwrights, pipefitters, and machine repairmen. Overall, the number of semiskilled workers will remain about the same.

Earnings and Working Conditions

Production workers in the automobile industry are among the highest paid in manufacturing. In 1972 they averaged $5.11 an hour, compared to $3.81 an hour for production workers in all manufacturing industries.

Besides wages and salaries, automobile workers receive a wide range of fringe benefits. They are paid one and one-half times their normal wage for working more than 8 hours a day, 40 hours a week or working Saturday. They receive premiums for working late shifts, and double the normal wage for Sundays and holidays. Most workers get paid vacations (or payment instead of vacations) and 12 paid holidays a year. Most companies provide annual wage increases, plus automatic increases when the cost of living rises. Life, accident, and health insurance are provided, also.

A great majority of the industry's workers are covered by company-paid retirement plans. Retirement pay varies with the length of service. Many plans provide for retirement at age 55, or after 30 years service regardless of age.

Most wage workers and some salaried employees receive supplemental unemployment benefit plans, paid for entirely by their employers. These plans provide pay during layoff and short work week benefits when workers are required to work less than a full week. During layoff, provisions are included for life, accident, and health insurance; survivor income benefits; relocation allowances; and separation payments for those laid off 12 continuous months or more.

Most wage workers and some salaried workers are required to join a union, usually within 40 days after they are hired. Most production and maintenance workers in assembly plants, and a majority in parts plants belong to the International Union, United Automobile, Aerospace and Agricultural Implement Workers of

America. In some parts plants, the International Union, Allied Industrial Workers of America is the bargaining agent. Other workers belong to the International Association of Machinists and Aerospace Workers; the Pattern Maker's League of North America; the International Molders' and Allied Worker's Union of North America; the Metal Polishers Buffers, Platers, and Helpers International Union; the International Union, United Plant Guard Workers of America (Ind.); the Mechanics Educational Society of America; the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio, and Machine Workers; and the International Die Sinkers' Conference (Ind.).

Most automobile industry employees work in plants that are relatively clean and free of dust, smoke, and fumes. Some work areas, however, are hot, noisy, and filled with dust and fumes. These conditions have been greatly improved by the introduction of better ventilation and noise control systems.

Automobile plants are comparatively safe places to work, although safety conditions vary among individual shops or plants. The rate of disabling injuries in automobile plants has been less than half that in all manufacturing in recent years. Some plants have fully equipped medical facilities with doctors and nurses.

Sources of Additional Information

Further information on employment and training opportunities in the automobile industry can be obtained from local offices of the State employment service; employment offices of automobile firms; locals of the unions listed above; and from:

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

Motor Vehicle Manufacturers Association of the U.S., Inc., 320 New Center Building, Detroit, Mich. 48202.

Information on careers in automotive engineering and a list of schools offering automotive engineering courses are available from:

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, N.Y. 10001.

OFFICE MACHINE AND COMPUTER MANUFACTURING OCCUPATIONS

During the last decade, employment in the office machine and computer industry grew four times faster than employment in manufacturing as a whole. Growth was spearheaded by a rapid expansion in the production of computers. For many years, the industry's chief products were typewriters, adding machines, calculators, and other conventional office machines. Today, plants that make computers account for more than half of the industry's production.

Nature and Location of the Industry

In 1972, the office machine and computer manufacturing industry employed 245,000 workers in approximately 870 plants. About 7 out of every 10 of them worked in plants that produced computer equipment, the remainder in plants that produced conventional office machines and scales and other weighing devices.

Computer equipment manufacturing plants employed about 172,000 workers in 1972. These plants manufacture general purpose computers as well as those used for special applications, such as space exploration and missiles. They also manufacture related equipment such as machines that read magnetic numbers on bank checks. In addition to computers and related equipment, plants may furnish "software" (computer programs and operating systems). Thousands of people whose employment is not included in this chapter are employed outside manufacturing plants by firms that specialize in software or that rent or lease computers and provide related services.

In 1972, more than 70,000 people were employed in factories that produced conventional office machines and scales. Of this total, about 30,000 produced desk calculators, cash registers, coin and ticket counters, and adding, accounting, and voting machines; another 27,000 produced industrial and household scales and miscellaneous office machines, including items as diverse as postage meters and dictating machines; and the rest produced typewriters.

Large plants account for most of the employment in office machine and computer manufacturing. About 7 out of every 10 of the industry's employees are in plants that have 1,000 or more employees; several computer plants have more than 5,000 employees.

New York, California, and Minnesota have about two-thirds of computer manufacturing employment, and the following States account for most of the remainder: Massachusetts, Pennsylvania, Florida, Arizona, and Colorado. In New York, the lower Hudson River Valley area has many important computer manufacturing centers: Poughkeepsie, East Fish Kill, and Kingston. Large manufacturing plants also are located in Rochester and Utica, N.Y., and in the Boston, Mass., and Philadelphia, Pa. areas. The leading center in the Midwest is Minneapolis-St. Paul. The Los Angeles industrial area is the most important computer manufacturing center in the West, followed by Phoenix, Ariz.; and San Jose, Calif.

Seven States account for two-thirds of the employment in plants manufacturing conventional business machines and scales: Ohio, New York, California, Illinois, Connecticut, New Jersey, and Kentucky. The following areas are some of the important manufacturing centers: Dayton, Toledo, and Euclid, Ohio; the New York-Northeastern New Jersey industrial area; Hartford and Stamford, Conn.; Chicago, Ill.; Detroit, Mich.; and Lexington, Ky.

Occupations in the Industry

A variety of occupations, requiring a broad range of training and skills, are found in plants that make office machines and computers. More than half of the industry's workers are in white-collar jobs (engineering, scientific, technical, administrative, sales, and clerical); the others are in plant jobs (assembly, inspection, maintenance, transportation and service).

White-collar workers represent a significantly larger proportion of total employment in the computer industry than in most other manufacturing industries.

Some of the key occupations in this industry are described briefly in the following section. (Detailed discussions of professional, technical, skilled, and other occupations found in the office machine and computer industry, as well as in many other industries, are given elsewhere in the *Handbook*, in sections covering individual occupations.)

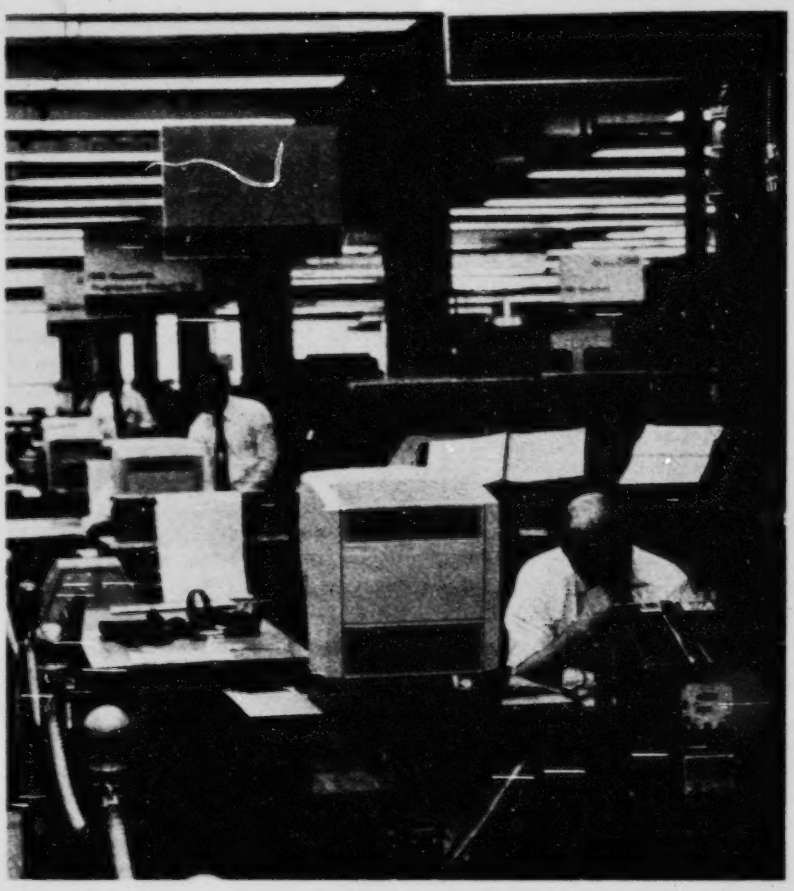
Engineering and Scientific Occupations. Nearly 1 out of every 10 workers in the office machine and computer industry is an engineer or scientist—a much greater proportion than in most industries. Most of them work at computer plants.

The largest group of engineers work with electricity or electronics. Most are engaged in research and development, although many work in

production. The industry also employs large numbers of mechanical and industrial engineers. Some mechanical engineers are engaged in product development and tool and equipment design. Others are concerned with the maintenance, layout, and operation of plant equipment. Industrial engineers determine the most effective means of using the basic factors of production—labor, machines, and materials.

Chemists make up the largest group of scientists in office machine and computer manufacturing. Their work is primarily in chemical processing of printed circuits used in computers. Mathematicians make up another large group of scientists. Their work on complex mathematical problems is important in designing computers. Physicists are employed in research and development work on items such as miniaturized components and circuits. Statisticians work in fields such as quality control and production scheduling.

The industry also employs systems analysts and computer programmers, many of whom have scientific or engineering backgrounds. Systems analysts primarily devise new information processing techniques and improve existing techniques. Programmers design and test computer programs. Some analysts and programmers specialize in scientific and engineering problems, while others process accounting, inventory, sales, and other business data. Systems analysts and programmers may assist salesmen in determining data processing needs of customers.



Technicians testing and debugging computers.

Technical Occupations. More than 1 out of every 20 workers in the industry is a technician. Most specialize in electronics and assist engineers and scientists in research and development, testing and inspecting electronic components, and doing complex assembly work. Some electronics technicians specialize in repairing computers. Chemical control technicians prepare solutions used in the etching of circuit boards. Photographic technicians set up cameras and other equipment used in the tracing process to create copper etchings on circuit boards. Draftsmen prepare drawings from sketches or specifications furnished by engineers. Engineering aids assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components.

Administrative and Sales Occupations. About 1 out of every 13 workers is an administrator. Included are top executives who manage companies and determine policy decisions and middle managers who direct departments such as advertising and industrial relations. Other administrative employees in staff positions include accountants, lawyers, and market researchers.

Sales personnel hold about 1 out of every 25 jobs in the industry. Salesmen of conventional office machines usually work on their own. Computer salesmen, on the other hand, are assisted by a host of technical experts, such as engineers and systems analysts. Because computers are complex and expensive, computer salesmen may have to

spend several months to complete a sale.

Clerical Occupations. Nearly 1 out of every 6 workers in the industry is in a clerical job. Included in this group are secretaries, clerk-typists, file clerks, bookkeepers, and business machine operators, as well as computer personnel such as keypunch and computer operators.

Plant Occupations. Nearly half of this industry's employees are plant (blue-collar) workers. Most plant workers are engaged directly in making computers and office machines. These workers include assemblers, inspectors or testers, machinists, machine tool operators, and the foremen who supervise them. Truckdrivers, material handlers, power truck operators, guards, and janitors move materials and perform custodial duties, and plumbers and pipefitters, electricians, carpenters, and other workers maintain production machinery and building facilities.

Assembly Occupations. (D.O.T. 590.885; 692.782; 706.884; 726.781 and .884) Workers who assemble computers and office machines have many different skills, and make up the largest group of plant workers.

Assemblers may put together small parts to make components or components to make sub-assemblies or the finished product. Much of their work is done by hand. Some hand assemblers do a single operation as components move down the assembly line. The assembly of typewriters, for example, is divided into many simple operations. Each assembler does one job as the typewriter passes the work station. Some assembly jobs are difficult and require great skill, while others are relatively simple. Skilled electronics assemblers, for example, use diagrams as guides to wire complex memory and logic panels for computers. Machines are used for many assembly operations. Automatic wire-wrapping machines, for example, wire panels and plugboards. Operators feed these machines and remove and inspect finished items.

Electronic technicians usually do the most difficult hand assembly work. In research laboratories, they put together experimental equipment. In plants, they put together complex items that require a knowledge of electronics theory.

Assemblers commonly use screw drivers, pliers, snippers, and soldering irons and they use special devices to position and hold parts during assembly. Some assemblers use precision equipment to weld connections in circuit assemblies.

Machining Occupations. Most office machine and computer manufacturing plants employ metal machining workers who operate power-driven machine tools to produce metal parts for computers, typewriters, accounting machines, calculators, and other products. Numerical control machine operators tend machines that have been programmed to perform machining operations automatically. Toolmakers construct and repair equipment used to make and assemble parts. Diemakers specialize in metal forms (dies) used in punch and power presses that shape metal parts.

Inspection and Testing Operations. Testing and inspection begin when raw materials enter the plant and continue throughout the assembly process. Finished parts and products are tested and inspected thoroughly.

Some inspectors examine individual parts; others inspect components during subassembly; still others inspect completed office machines and computers. Many inspecting jobs require highly skilled workers. On the other hand, relatively unskilled people can run some automatic test equipment. Workers who feed or monitor the equipment are called test-set operators or testing machine operators.

Job titles indicate the work many inspectors do. *Machined parts inspectors* (D.O.T. 609.381) use precision testing instruments to determine whether parts have been machined properly. *Type inspectors* (D.O.T. 706.687) use a magnifying glass to examine typewriter type for defects. *Electronic subassembly inspectors* (D.O.T. 726.384) use microscopes, meters, and various measuring devices to examine circuits and other electronic subassemblies. *Electronic assembly inspectors* (D.O.T. 722.281) use special instruments to test electronic systems such as computer memory units.

In plants that manufacture conventional office machines, final inspection is relatively simple. Inspectors operate the machines, look for defects, and refer malfunctioning machines to repairmen. The final inspection or "debugging" of computers, on the other hand, is very complex. Electronic technicians inspect new computers under the supervision of electronic engineers. They use complex equipment to run tests and detailed drawings and instructions to find causes of malfunctions.

Maintenance Occupations. Many maintenance workers with different types of training take care of the industry's production machinery and equipment. Skilled electricians are responsible for the maintenance of electrical equipment. Machine and equipment repairmen make mechanical repairs. Maintenance machinists and welders build and repair equipment. Air-conditioning and refrigeration mechanics are employed in plants which are air-conditioned and have special refrigerated and dust-free rooms. Painters, plumbers, pipefitters, carpenters, sheet-metal workers, and other building maintenance craftsmen also are employed.

Other Plant Occupations. Many

truckdrivers are employed to make deliveries to various parts of plants. Laborers load and unload trucks and boxcars and do general clean-up work. Some other plant occupations are boiler operator, stationary engineer, guard, and janitor.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering or one of the sciences is usually required for engineering and scientific jobs. For research and development work, applicants with advanced degrees generally are preferred. Some companies have training programs designed to give young college graduates a broad picture of manufacturing operations before they are assigned to a particular department. Because of the highly technical nature of computers, many of the industry's executives have backgrounds in engineering or science.

Engineers and scientists, as well as graduates of business administration and liberal arts colleges, are employed as salesmen, programmers, and systems analysts. Most business and liberal arts graduates, however, are employed in accounting, labor-management relations, and other administrative activities.

Technicians qualify for their jobs in a number of ways. Some obtain training in either a public, private, or Armed Forces technical school. Others have one or more years of scientific or engineering training, but have not completed all of the requirements for a degree. Still other technicians are promoted from lower grade jobs in the plant. A few well-qualified technicians have advanced to engineering jobs, after completing courses in mathematics, engineering, and related subjects.

People who complete commercial courses in high school or business school are preferred in clerical jobs such as stenographer or office machine operator. For computer operators, most firms prefer applicants who have some college or technical training in data processing. With additional training, some computer operators and clerical workers advance to programmer jobs.

In selecting workers for plant jobs, firms generally prefer high school or vocational school graduates, who are then trained through on-the-job instruction and experience that varies from a few days to years. Some plants also conduct classroom training of short duration. Skilled craftsmen, such as machinists and tool and die makers, may spend 3 to 4 years in learning their jobs and some firms have formal apprenticeship programs, which include both on-the-job training and classroom instruction related to the particular craft. Frequently, openings for skilled jobs are filled by qualified young workers already in the plant.

Workers who have little or no previous experience or training are hired for less skilled inspection, assembly, and machining jobs. Applicants may have to pass aptitude tests and demonstrate ability for particular types of work. Most assembly and inspection jobs require good eyesight and color perception, manual dexterity, and patience.

Experienced plant workers have opportunities to advance to jobs with higher pay. Assemblers, for example, can become semiskilled inspectors, and eventually skilled inspectors. Machine tool operators can move to skilled machinist jobs. Craftsmen and skilled inspectors can become technicians, after completing courses in company-operated schools, junior colleges, or technical schools. Foremen jobs are open to well-qualified plant workers who have supervisory ability.

Employment Outlook

Employment in this industry is expected to increase rapidly through the mid-1980's. In addition to the job openings that result from employment growth, many openings will arise as experienced workers retire, die, or transfer to jobs in other industries.

Employment growth is expected to be concentrated in plants that produce electronic computer equipment as the demand for computers and related equipment continues to increase. As the economy expands and becomes more complex, computers will become increasingly useful to business, government agencies, and other organizations. Demand also will be stimulated as new uses for computers are developed. Growth in the number of computers will be accompanied by a need for additional computer-related equipment—input and output, storage, and communication devices.

Employment in plants that produce conventional office machines is expected to grow slowly. Most job openings will result from the need to replace experienced workers who retire, die, or transfer to other industries. The demand for most types of office machines is expected to rise rapidly as business and government organizations grow and the volume of paperwork increases. However, imported machines have been gaining a greater share of the office machinery market and this trend may continue. Moreover, technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations formerly done by hand will tend to reduce labor requirements, particularly in plants where products are mass-produced, such as typewriters and calculators.

Some occupational groups in the office machine and computer manufacturing industry are expected to grow faster than others. For example, the number of profes-

sional and administrative workers, particularly engineers, scientists, technicians, systems analysts, and programmers, is expected to increase more rapidly than the number of clerical and plant workers. Demand for these workers will be spurred by continued high levels of research and development expenditures to improve production processes, advance machine capabilities, and broaden the use of computers.

Secretaries, stenographers, typists, and computer operating personnel will account for most of the growth in clerical occupations. More extensive use of computers in routine paperwork may result in a decline in the employment of bookkeepers and file clerks.

Semiskilled production workers, such as assemblers and inspectors, will continue to account for most of the work force in plant occupations, despite the growing use of automated and mechanized assembly line equipment.

Earnings and Working Conditions

Earnings of plant workers in the office machine and computer industry are higher than the average for other manufacturing industries. In 1972, they averaged $4.13 an hour, compared with $3.81 an hour for plant workers in manufacturing industries as a whole.

National wage data are not available for individual occupations in the office machine and computer industry. However, the following tabulation, based on data obtained from a small number of union contracts, provides an example of the range in hourly wage rates for selected occupations in 1972:

	Hourly rate ranges
Assemblers	$2.16–3.74
Machinists	3.50–4.15
Inspectors	2.16–4.29
Wire-wrapping machine operators	3.14–4.38
Tool and die makers	4.01–4.39
Electricians	3.60–4.61

Some employees work night shifts and weekends because many plants operate around the clock. Employees working second or third shifts, or more than 8 hours a day or 40 hours a week generally receive extra pay.

Paid vacations and holidays are almost universal in this industry. Most employees receive 1 to 4 weeks of vacation, depending on length of service. They also receive insurance and pension benefits at least partially financed by the employer. Employee stock purchase plans are available in many firms.

In general, the work surroundings in office machine and computer plants are more favorable than those in most other types of factories. Work stations usually are well-lighted and clean, and free from dust, fumes, and loud noises. Many computer factories are relatively new and are located in suburban areas.

Some plant jobs are repetitious, but very few require great physical effort. Fewer and less severe injuries take place in office machine and computer manufacturing than the average for all manufacturing.

Many plant workers are covered by union contracts. The principal unions in this industry are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

Computer and Business Equipment Manufacturer's Association 1828 L. St. NW., Washington, D.C. 20036.

American Federation of Information Processing Societies, Inc., 210 Summit Ave., Montvale, N.J. 07645.

OCCUPATIONS IN THE PAPER AND ALLIED PRODUCTS INDUSTRIES

In 1972, the paper and allied products industry employed about 700,000 people to produce many different kinds of paper and paperboard products. The industry employs workers in occupations ranging from unskilled to highly specialized technical and professional jobs, many found only in the paper industry.

About 140,000 women worked in this industry in 1972 Many worked in office jobs; others worked in plant jobs, mainly as machine operators and inspectors.

Nature and Location of the Industry

The paper industry is highly mechanized. Pulp, paper, and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations that require very little handling of materials by workers. Manufacturing plants in the paper industry are engaged in one or more of three different operations: the production of pulp (the basic ingredient of paper) from wood, reused fibers, or other raw materials; the manufacture of paper or paperboard (thick paper) from pulp; or the conversion of rolls or sheets of paper or paperboard into finished products.

The largest group of employees in the industry work in mills that produce pulp, paper, or paperboard. The next largest group work in plants that make boxes and containers; and the remainder in plants that make a variety of other paper products.

More than 80 percent of the industry's employees work in factories employing 100 workers or more each.

Workers in this industry are located throughout the country, although about half are employed in eight States: New York, Pennsylvania, Ohio, Illinois, Wisconsin, Massachusetts, New Jersey, and California, Other States having large numbers of paperworkers are Michigan, Georgia, Washington, Maine, Florida, Texas, North Carolina, and Alabama.

Occupations in the Industry

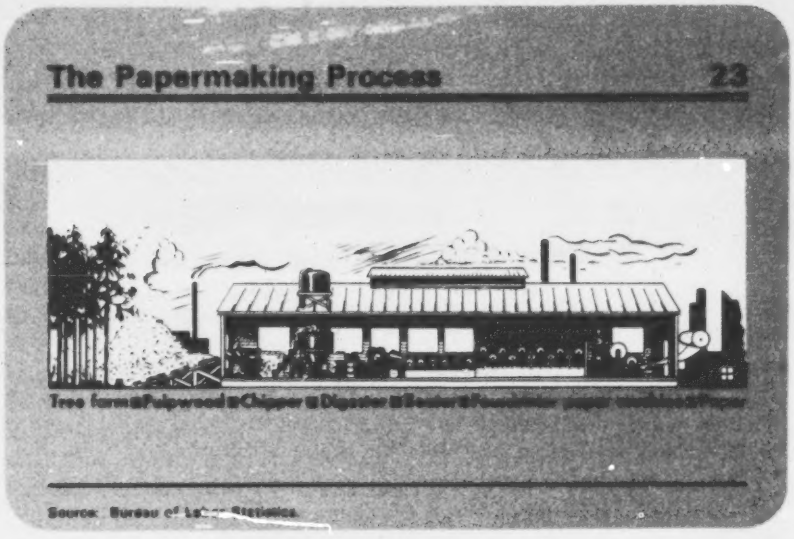
Employees in the paper industry work in a variety of occupations, requiring a broad range of training and skills. Many workers operate and control specialized papermaking, finishing, and converting machines. Some workers install and repair papermaking machinery. Truck drivers make deliveries, and other workers load and unload trucks, railroad cars, and ships. Other workers keep inventory records of stock and tools.

The industry employs many workers in clerical, sales, and administrative occupations. For example, it employs purchasing agents, personnel managers, salesmen, office clerks, stenographers, bookkeepers, and business machine operators. Also, because of the complex processes and equipment used, the industry employs many professional and technical workers, including chemical and mechanical engineers, chemists, laboratory technicians, and pulp and paper testers. (Detailed discussions of professional, technical, and mechanical occupations, found not only in the paper industry but in other industries, are given elsewhere in the *Handbook* in sections covering individual occupations.

Production Jobs. In 1972, more than three-fourths of all employees in the industry worked in production jobs. The simplified description of papermaking occupations and processes that follows applies to a plant which combines the production of pulp, paper, and finished paper products into one continuous operation. (See chart 23.)

After logs are received at the pulp mill, the bark is removed. One machine used for this operation is a large revolving cylinder known as a "drum barker." Logs are fed mechanically into this machine by a semiskilled worker called a *barker operator* (D.O.T. 533.782). The machine cleans bark from the logs by tumbling them against each other and also against the rough inner surface of the drum. Next, pulp fibers in the logs are separated from other substances by a chemical or mechanical process, or both, depending on the type of wood used and the grade of paper desired.

In the mechanical process, pulpwood is held against a fast-revolving grindstone that separates the fibers. In the more commonly used chemical process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipperman* (D.O.T. 668.885). The machine cuts the pulpwood into chips about the size of a quarter. These wood chips are "cooked" with chemicals under high temperature and pressure in a "digester," a kettlelike vat several stories high. The digester is oper-

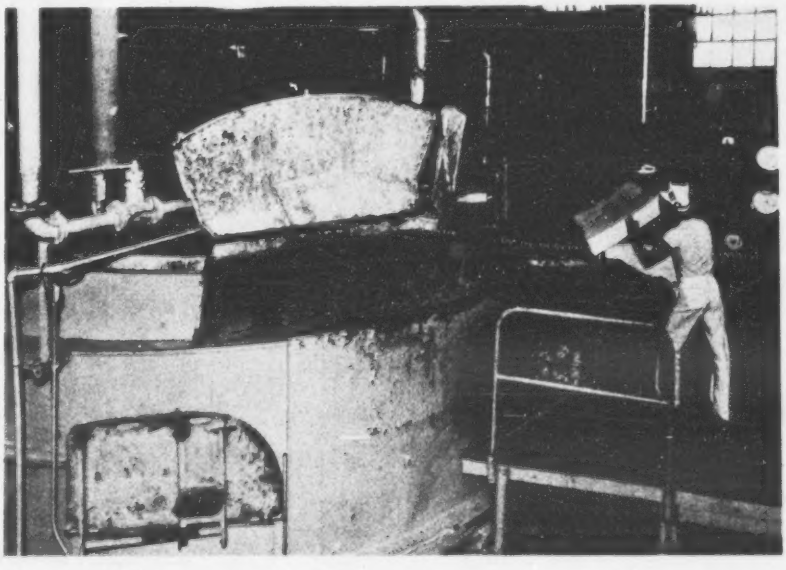


ated by a skilled worker called a *digester operator* (D.O.T. 532.782). He determines the amount of chemicals to be used and the cooking temperature and pressure; he also directs the loading of the digester with wood chips and chemicals. By checking an instrument panel he makes certain that proper conditions are being maintained. When the pulp fibers are removed from the digester, they are washed to remove chemicals, partially cooked chips, and other impurities. These fibers, called pulp, resemble wet, brown cotton.

To turn pulp into paper, the pulp is mixed thoroughly with water and further refined in a machine operated by a skilled worker called a *beater engineer* (D.O.T. 530.782). The kind and amount of chemicals and dyes he uses and the length of time he "beats" the solution determines the color and strength of the paper.

The pulp solution, now more than 99 percent water, is turned into paper or paperboard by machines which are among the largest in American industry. The machines are of two general types. One is the Fourdrinier machine, by far the most commonly used; the other is the cylinder machine used to make particular types of paper, such as building and container board. In the Fourdrinier, the pulp solution pours into a continuously moving and vibrating belt of fine wire screen. As the water drains, millions of pulp fibers adhere to one another, forming a thin wet sheet of paper. After passing through presses that squeeze out more water, the newly formed paper passes through the dryer section of the papermaking machine to evaporate remaining water.

The quality of the paper produced largely depends on the skill of the *paper machine operator* (D.O.T. 539.782). He controls the "wet-end" of the papermaking machine to form paper of specified thickness, width, and physical strength. He checks control-panel instruments to make sure the flow of pulp and the speed of the machine are coordinated. The paper machine operator also determines whether the paper meets required specifications by interpreting laboratory tests or, in some instances, by visually checking or feeling the paper. He supervises the less skilled workers of the machine crew and, with their help, keeps the paper moving smoothly through the machine. The *backtender* (D.O.T. 532.885), who is supervised by the paper machine operator, controls the pressure and temperature of machinery that dries and finishes the paper and gives it the correct thickness. He inspects the paper for imperfections, and makes sure that it is being wound tightly and uniformly into rolls. The backtender also adjusts the machinery that cuts the rolls

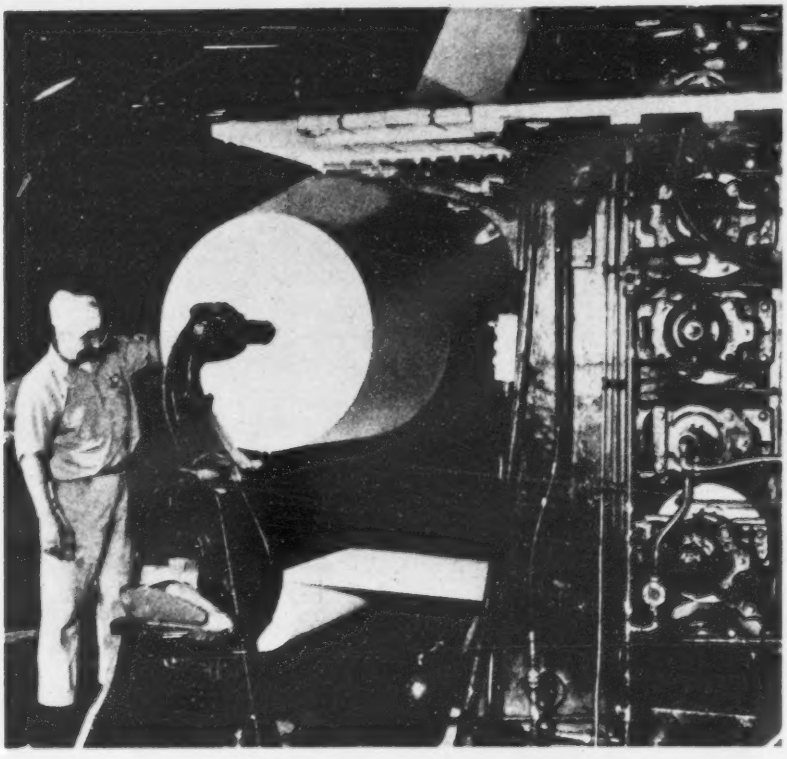


into smaller rolls and, with the help of assistants, may weigh and wrap the rolls for shipment.

Paper mills that produce a fine grade of paper for books, magazines, or stationery usually have finishing departments. Most workers in these departments are either semiskilled or unskilled. One semiskilled worker, the *supercalendar operator* (D.O.T. 534.782), aided by several helpers and by mechanical handling equipment, places huge rolls of paper onto a machine that gives the paper a smooth and glossy finish. He also inspects the finished paper to make sure that specifications have been met. Another semiskilled worker, the *paper sorter and counter* (D.O.T. 649.687), inspects sheets of paper for tears, dirt spots, and wrinkles; counts them; and may fill customer orders.

In converting plants, machines operated by semiskilled or skilled workers convert paper and paperboard into envelopes, napkins, corrugated shipping containers and other paper products. Occupations in converting plants differ widely, depending largely on the product being manufactured. An example of a semiskilled worker is the *envelope machine operator* (D.O.T. 641.885) who feeds and tends an automatic machine that makes envelopes from either rolls of paper or prepared envelope blanks. One of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 651.782) who controls a machine that cuts and creases paperboard sheets and prints designs or lettering on them.

Converting plants employ thousands of workers to print designs and lettering on bags, labels, wallpaper, and other paper products. Among these are compositors who set type, and pressmen who prepare and operate printing presses.



Maintenance Jobs. The paper industry employs many skilled maintenance workers to care for its complex machinery and electrical equipment. *Millwrights* install and repair machinery. They also take apart and reassemble machines when they are moved about the plant. *Instrument repairmen* install and service instruments that measure and control the flow of pulp, paper, water, steam, and chemical additives. The job of instrument repairman is becoming increasingly important with the greater use of automatic control equipment.

Other important maintenance employees include *electricians,* who repair wiring, motors, control panels, and switches; maintenance machinists, who make replacement parts for mechanical equipment; and *pipefitters,* who lay out, install, and repair pipes.

Stationary engineers are employed to operate and maintain powerplants, steam engines, boilers, air compressors, and turbines.

Professional and Technical Occupations. The complexity of pulp and paper manufacturing requires thousands of workers who have engineering, chemical, or other technical training. Approximately 15,000 scientists and engineers and 7,000 technicians were employed by the paper industry in 1972.

Many chemists are employed to control the quality of the product by supervising the testing of pulp and paper. In research laboratories, chemists study the influence of various chemicals on pulp and paper properties. In addition, some chemists and engineers are employed as salesmen, supervisors of plant workers, or as administrators in positions requiring technical knowledge.

Chemical and *mechanical engineers* transform new pulp and papermaking techniques into practical production methods. Some chemical engineers supervise the production process. *Electrical engineers* supervise the operation of power-generating and distributing equipment and instruments.

Packaging engineers design and supervise the production of containers and packages. A few box manufacturers also employ artists who develop letterings, designs, and colors for containers.

Foresters manage large areas of timberland and assist in the wood-buying operations of pulp and paper companies. They map forest areas, plan and supervise the harvesting, and seed or plant new trees to assure continuous production of timber.

Systems analysts and *computer programmers* are becoming increasingly important to this industry due to the greater use of computerized controls in the production process. They analyze business and production problems and convert them to a form suitable for solution by computer.

Frequent tests are performed during the manufacture of pulp or paper to determine whether size, weight, strength, color, and other properties meet standards. Some testing is done by machine operators, but in many mills *testing technicians* are employed. These employees, who have job titles such as laboratory technician, pulp tester, and chemical analyst, also assist engineers and chemists in research and development activities.

Administrative, Clerical and Related Occupations. The paper industry employs many administrative, clerical, and other office personnel. Executives plan and administer company policy. To work effectively, executives require information from a wide variety of personnel, including accountants, sales representatives, lawyers, and personnel in industrial relations, transportation, market research, and other activities. Bookkeepers, secretaries, shipping clerks, and other clerical workers keep records of personnel, payroll, inventories, sales, shipments, and plant maintenance.

Training, Other Qualifications, and Advancement

Paper and pulp companies generally hire and train inexperienced workers for production and maintenance occupations. Many companies prefer to hire high school graduates between the ages of 18 and 25. Inexperienced workers usually start as laborers or helpers and advance along fairly well-defined paths to more skilled jobs.

Some large plants have formal apprenticeship programs for maintenance workers. Under these programs, which usually last 3 to 4 years, young people are trained for jobs, such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and similar qualifying tests. Apprenticeship includes both on-the-job training and classroom instruction related to the occupation. The machinist apprentice, for example, receives classroom instructions in mathematics, blueprint reading, and shop theory.

A bachelor's degree is usually the minimum educational requirement for scientists, engineers, foresters, and other specialists. For research work, persons with advanced degrees are preferred. Many engineers and chemists (called *process engineers* and *paper chemists*) have specialized training in paper technology. A list of schools offering such training is available from the American Paper Institute, 260 Madison Ave., New York, N.Y. 10016. Many companies have summer jobs for college students specializing in papermaking, and upon graduation frequently hire them on a permanent basis. Some associations, colleges, and individual companies offer scholarships in pulp and papermaking technology.

Some companies have formal training programs for college graduates with engineering or scientific backgrounds. These employees before being assigned to a particular department may work for brief periods in various parts of the plant to gain a broad knowledge of pulp and paper manufacturing. Other firms immediately assign junior chemists or engineers to a specific research, operation, or maintenance unit.

Generally, no specialized education is required for laboratory assistants, testing technicians, or other kinds of technicians. Some employers, however, prefer to hire technical institute or junior college graduates. Beginning technicians start in routine jobs and advance to positions of greater responsibility after they acquire experience and can work with minimum supervision.

Administrative positions usually are filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. A knowledge of paper technology is helpful for administrators and sales occupations. This is true especially for salesmen who give customers technical assistance. Most pulp and paper companies employ clerks, bookkeepers, stenographers, and typists who have had commercial courses in high school or business school.

For production workers, promotion generally is limited to jobs within a "work area," which may be a

department, section, or an operation on one type of machine. To become a paper machine tender, for example, the worker may start as a laborer, wrapping and sealing finished rolls of paper as they come off the papermaking machine. As he gains experience and skill, he moves to more difficult assignments, finally he may become a machine tender in charge of operating a machine. These promotions may take years, depending on the availability of jobs. Experience gained within a work area usually is not transferable; unskilled or semiskilled workers who transfer to jobs outside their seniority area or to other plants usually must start in entry jobs.

Many plant foremen and supervisors are former production workers. In some plants, qualified workers may be promoted directly to foremen or other supervisory positions. In others, workers are given additional training before they are eligible for promotion. This training often is continued after the worker is promoted—through conferences, special plant training sessions, and sometimes courses at universities or trade schools. Most firms provide some financial assistance for employees who take courses outside the plant.

Employment Outlook

Employment in the paper and allied products industry is expected to grow moderately through the mid-1980's. Most openings, however, will stem from the need to replace experienced workers who retire, transfer to jobs in other industries, or die.

Paper production is expected to increase substantially as population and businesses grow and new uses for paper are developed. Rising population, for example, will create a greater demand for textbooks, writing papers, magazines, and newspapers. Business expansion will heighten the need for paper products, such as business forms and packaging. Employment will grow at a slower rate than production, however, because of the increasing use of laborsaving machinery.

Occupational groups in the industry are expected to grow at different rates. The numbers of engineers, scientists, technicians, and maintenance workers are expected to increase faster than other occupational groups in the industry. More scientific and technical personnel will be needed as research and development activities expand, and more maintenance workers will be required to service the growing inventory of complex machinery. Employment of administrative and clerical workers also is expected to rise at a faster pace than total employment. The number of production workers, on the other hand, may decline slightly as more laborsaving machinery is introduced. Nevertheless, replacement needs will create many job openings for production workers.

Earnings and Working Conditions

Production workers in the paper industry had average earnings of $3.94 an hour in 1972. In the same year, production workers in all manufacturing industries averaged $3.81 an hour.

The following tabulation, based on information from a score of union-management contracts in the paper industry, illustrates the approximate range of hourly wage rates for selected production and maintenance occupations in 1972. Local rates within these ranges depend on geographic location, type and size of mill, kinds of machines used, and other factors.

	Hourly rate ranges
Production occupations:	
Barker operator, drum	$3.08-4.57
Chipperman	2.87-4.03
Digester operator (cook)	3.37-5.11
Head stock preparer (beater engineer)	3.66-5.13
Beaterman	3.12-4.62
Paper machine tender	3.02-7.50
Backtender	3.51-7.12
Supercalendar operator	3.52-4.74
Maintenance occupations:	
Pipefitter	3.06-5.38
Machinists	3.48-5.25
Electrician	3.11-5.21
Millwright	4.15-5.22

Most pulp and paper plants operate around the clock—three shifts a day, 7 days a week. Production workers can expect to work on evening or night shifts from time to time. Maintenance workers usually are employed on the regular day shift.

In most plants the standard workweek is 40 hours; in a few it is 36 hours or less. Workers normally have year-round employment because paper production is not subject to seasonal variations.

Paid vacations and holidays are almost always provided. Pension plans and life and health insurance usually are financed completely or partially by paper companies. Employee stock-purchase and savings plans, to which the company makes contributions, are also available in some firms.

Most pulp and papermaking jobs do not require strenuous physical effort. Some employees, however, work in hot, humid, and noisy areas. They also may be exposed to disagreeable odors from chemicals in the papermaking process. The rate of disabling injuries in this industry has been about the same as the rate for all manufacturing in recent years.

A majority of the production workers are members of trade unions. A large number belong to the

International Brotherhood of Pulp, Sulphite and Paper Mill Workers; the United Papermakers and Paperworkers; or the Association of Western Pulp and Paper Workers. Many printing workers belong to the International Printing Pressmen and Assistants' Union of North America. Some maintenance workers and other craftsmen belong to various craft unions.

Sources of Additional Information

Further information about job opportunities in this industry is available from local offices of the State employment service and from:

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

Fibre Box Association, 224 South Michigan Ave., Chicago, Ill. 60604.

National Paper Box Manufacturers Association, Inc., 121 North Broad St., Philadelphia, Pa. 19107.

Paper Industry Management Association, 2570 Devon Ave., Des Plaines, Ill. 60018.

Information on job opportunities for paper and paper products salesmen may be obtained from:

National Paper Trade Association, Inc., 420 Lexington Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE PETROLEUM REFINING INDUSTRY

The petroleum and natural gas industries provide about 75 percent of all the energy fuels consumed in this country. Crude oil products supply the fuels and lubricants used for motor vehicles, locomotives, aircraft, and ships. Oil and gas provide much of the heat for homes, factories, and stores, as well as the fuel for over one-quarter of the electric power generated in this country. In addition, basic petroleum compounds are used to manufacture hundreds of everyday products such as synthetic rubber and plastics.

In 1972 about 150,000 workers, who have a wide range of educational backgrounds and skills, were employed in the petroleum refining industry. This chapter deals only with occupations and activities involved in refining oil. Occupations in petroleum and natural gas production and processing are discussed in a separate chapter elsewhere in the *Handbook*.

Nature and Location of the Industry

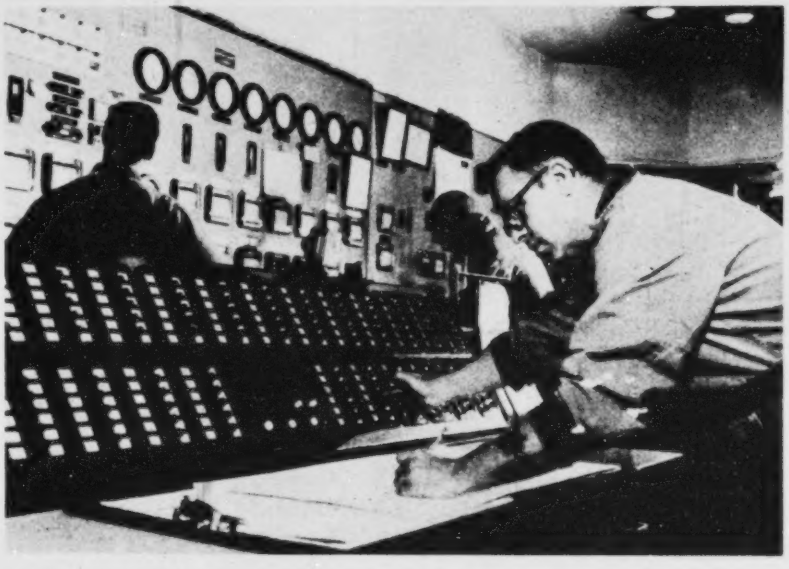
A modern refinery is a complicated plant made up of tanks and towers connected by a maze of pipes. From the time crude oil enters the refinery to the shipment of finished products, the flow of production is almost continuous. Operators use instruments to measure and regulate the flow, volume, temperature, and pressure of liquids and gases going through the equipment. Manual handling of materials is virtually eliminated.

Briefly, the first step in petroleum refining consists of heating crude oil as it flows through a series of pipes in a furnace. The vapors from the heated oil pass into a tower where the various "fractions," or parts, of the oil are condensed. The heaviest parts (for example, heavy fuel oils and asphalt) are drawn off along the bottom of the tower where temperatures are highest; lighter parts, jet fuel and diesel fuel are drawn off along the middle of the tower; and the lightest (gasoline and gases) are taken off at the top where temperatures are lowest. Further processing by more complicated methods combines or modifies compounds obtained through fractionating. Treating units are used to remove water, sulfur compounds, and other impurities.

About 250 refineries were in operation in this country in 1972. They ranged in size from plants with fewer than 50 employees to those with several thousand. Although many States have refineries, about 80 percent of the crude oil was refined in only 10 States: Texas, California, Louisiana, Illinois, Pennsylvania, Indiana, New Jersey, Ohio, Oklahoma, and Kansas. Refineries usually are located near oil fields, industrial centers, or deepwater ports where tankers can dock.

Occupations in the Industry

About 1 out of every 5 workers in refineries is an operator. A key worker in converting crude oil into usable products is the *stillman* (D.O.T. 542.280), or chief operator, who is responsible for one or more processing units. The stillman, with help from assistant operators, makes adjustments for changes in temperature, pressure, and oil flow. In the modern refineries, operators can watch instruments on panels that



Petroleum industry workers observing the control center of a refinery.

show the entire operation of all processing units in the refinery. From time to time, they patrol units to check their operating condition and to test samples.

Other plant workers include *pumpmen or pumpers* (D.O.T. 549.782) and their *helpers* (D.O.T. 549.884), who maintain and operate pumps that circulate petroleum products, chemicals and water; and *treaters* (D.O.T. 549.782), who operate equipment to remove impurities from gasoline, oil, and other products.

Many refineries employ large numbers of maintenance workers to repair, rebuild, and clean equipment. In other plants, maintenance work is contracted to companies outside the petroleum industry. Maintenance workers are needed because high heat, pressure, and corrosion quickly wear out the complex refining equipment. Included are skilled boilermakers, electricians, instrument repairmen, machinists, pipefitters, sheetmetal workers, and welders. Helpers and apprentices also are in these trades. Some skilled workers have a primary skill in one craft as well as the ability to handle closely related crafts. For example, a pipefitter also may be a boilermaker and welder. Maintenance workers who have such combined jobs are sometimes called refinery mechanics.

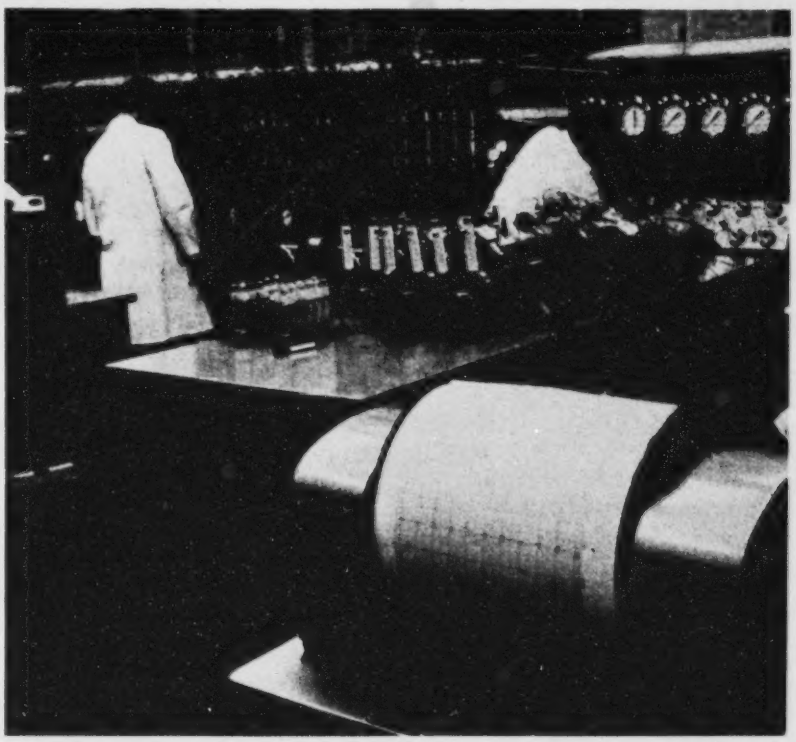
Plant workers who do not operate or maintain equipment do many other tasks. Some workers drive delivery trucks; some load and unload materials on trucks, trains, or ships; and others keep stock and tool inventory records. The industry also employs custodial workers such as guards and watchmen.

About 14 percent of the workers in petroleum refining are scientists, engineers, and technicians. Among these are chemists, chemical engineers, mechanical engineers, waste treatment engineers, laboratory technicians, and draftsmen. Chemists and laboratory technicians control the quality of petroleum products by making tests and analyses to determine chemical and physical properties. Some chemists and chemical engineers develop and improve products and processes. Laboratory technicians assist chemists in research projects or do routine testing and sample taking. Some engineers design chemical processing equipment and plant layout, and others supervise refining processes. Waste treatment engineers and technicians supervise and improve treatment and disposal of refinery waste waters and gases. Draftsmen prepare plans and drawings needed in refinery construction and maintenance.

Refining companies employ many administrative, clerical, and other white-collar personnel. Administrative workers include managers, accountants, purchasing agents, lawyers, and personnel and training specialists. Typists, secretaries, bookkeepers, and business machine operators assist administrative workers. (Detailed discussions of professional, technical, mechanical, and other occupations found not only in petroleum refining but also in other industries are presented elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New plant workers usually begin as aides in a labor pool where they move materials, pack cartons, fill barrels and do maintenance work. They may be transferred to the processing department or maintenance shop when a vacancy occurs. Aptitude testing and interviewing frequently are used in selecting applicants for plant jobs.



Oil industry scientists conduct experiments in oil company research.

Workers newly assigned to a processing department learn to operate equipment under experienced operators. Helpers may advance to assistant operator and then to chief operator. Formal training courses frequently are given in plant operation.

A foreman trains inexperienced workers in the maintenance shop. Some refineries have classroom instruction related to particular work. After 3 or 4 years, a person may advance from helper to skilled craftsman in one of the maintenance jobs. Some large refineries train workers in several crafts. For example, a qualified instrument repairman may be given electrician or machinist training.

For scientists and engineers a bachelor's degree in an appropriate field usually is the minimum educational requirement. Scientists and engineers with advanced degrees are preferred for research work. For most laboratory assistant jobs, 2-year technical school training is required.

Laboratory assistants begin in routine jobs and advance to positions of greater responsibility as they acquire experience and learn to work without close supervision. Inexperienced draftsmen begin as copyists or tracers, and can advance to more skilled drafting jobs.

Administrative positions generally are filled by men and women who have college degrees in science and engineering, accounting, industrial relations, or other specialized fields. For positions as clerks, bookkeepers, secretaries, and typists, most refineries employ persons who have had commercial courses in high school or business school. For occupations associated with computers, educational requirements range from a high school level for key punch operators to a college degree in the physical science field for analysts.

Employment Outlook

Employment in petroleum refining is expected to decline slowly through the mid-1980's. Nevertheless, job openings will result from the need to replace workers who retire, die, or transfer to jobs in other industries.

Refinery output will rise rapidly to meet the Nation's growing demand for petroleum products. Improved methods of refining crude oil and larger plants with greater capacity, however, will increase output per worker, and thus reduce employment needs.

Most jobs will be for professional, administrative, and technical workers, particularly chemical and mechanical engineers and technicians for research and development. More maintenance workers, such as electricians, pipefitters, and instrument repairmen also will be needed to take care of the increasing amount of automated equipment and complex control instruments.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in manufacturing. In 1972 production workers in petroleum refining averaged $5.25 an hour, compared with an average of $3.81 an hour for production workers in manufacturing industries as a whole. Refinery workers have better-than-average earnings because a large proportion are skilled.

Entry salaries for chemical engineers in the petroleum refining industry were among the highest in American industry, according to a survey conducted by the American Chemical Society in 1972. The average monthly salary for chemists who have a bachelor's degree and no experience was $800, and for chemical engineers $950.

Most petroleum refinery workers receive a 2-week vacation with pay after 1 year of service; 3 weeks after 5 years; 4 weeks after 10 years; and 5 weeks after 20 years. Refinery workers also receive paid holidays. Most refineries have health and life insurance and pension plans for their employees. Employee stock-purchase and savings plans, to which the employer makes contributions, are offered by many firms.

Because petroleum is refined around-the-clock, operators may be assigned to any one of the three shifts, or they may be rotated on various shifts. Some operators work weekends and get days off during the week. Employees usually receive additional pay for shift work. Most maintenance workers are on duty during the day. The industry has little seasonal variation and regular workers have year-round jobs.

Most refinery jobs require only moderate physical effort. A few workers, however, have to open and close heavy valves and climb stairs and ladders to considerable heights. Others may work in hot places or may be exposed to unpleasant odors. Refineries are relatively safe. The injury frequency rate has been less than half the rate for manufacturing as a whole.

Most refinery workers are union members and belong to the Oil, Chemical and Atomic Workers International Union. Some refinery workers are members of AFL-CIO craft unions or of various independent unions.

Sources of Additional Information

More information on job opportunities in the petroleum refining industry may be obtained from the personnel offices of individual oil companies. General information on jobs in the industry is available from:

National Petroleum Refiners Association, 1725 DeSales St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE PRINTING INDUSTRY

Printing is both an art and one of our chief means of communication. In 1972, the printing and publishing industry employed about 1.1 million workers. Government agencies and private firms that do their own printing, such as banks and insurance companies, also employed thousands of printing workers.

Nature and Location of the Industry

Included in the industry are the printing and publishing of newspapers, magazines, books, and advertising matter; the production of business forms; the production of greeting cards and gift wrappings; commercial or job printing; bookbinding; and the provision of typesetting, photoengraving, platemaking, and other printing services, primarily for printing establishments.

In 1972, the largest division in terms of employment was newspaper printing and publishing, with over 375,000 employees. Most daily and many weekly newspapers throughout the Nation do their own printing. Although some major newspapers have more than 2,000 employees many have fewer than 20.

Commercial printing shops, the second largest division of the industry employed about 344,000 workers. These shops produce a variety of materials, including advertising matter, business cards, calendars, catalogs, labels, maps, and pamphlets. They also print limited-run newspapers, books, and magazines. Many commercial shops have several hundred workers, but employment is concentrated in smaller shops.

Printing jobs are found throughout the country. Almost every town has at least one printing shop—frequently, a small newspaper plant that also may do other printing. However, more than half of the Nation's printing employees are in five States—New York, Illinois, California, Pennsylvania, and Ohio. Within these States, most printing activities are in or near manufacturing, commercial, or financial areas such as New York, Chicago, Los Angeles, Philadelphia, San Francisco-Oakland, Cincinnati, and Cleveland. Other leading centers of printing employment are Boston, Detroit, Minneapolis-St. Paul, Washington, D.C., St. Louis, and Baltimore. Employment in book and magazine printing is highly concentrated in these areas. A much larger proportion of employment in newspaper plants is found outside these centers because of the great number of small local newspapers.

Printing Methods

Printing is a means of transferring ink impressions of words and pictures to paper, metal, or other materials and printing methods have common characteristics. A plate of metal, wood, linoleum, rubber, or plastic is prepared so that part of it can be covered with ink. The ink is then transferred to a sheet of paper or other material that is pressed against the plate.

In relief printing, the letters and images stand up from the rest of the printing plate. Ink is rolled over the raised surface and then paper is pressed against it. In gravure printing, the image is etched into the surface of the plate. The whole surface is covered with ink and then wiped off; ink is left only in the sunken or etched areas. When paper is pressed against the surface, the ink is lifted out and appears on the paper. In lithography (offset printing), the printing plate surface is smooth, with both image and nonimage areas on the same level. Lithography is based on the principle that grease and water do not mix. The plate's image areas are coated with a substance to make the greasy printing ink stick to the plate and then moistened with water so that only the image areas take up the ink. The inked image is transferred from the plate to a rubber blanket and then to the paper.

Screen printing is a method in which inks or other materials such as paint and varnish are forced through a stencil mounted on a finely woven screen. The shape of the stencil openings determines the design to be printed. This process may be applied to a variety of surfaces such as paper, glass, metal, plastic, and textiles.

Printing Occupations

Production of printed materials requires workers in a wide variety of occupations. Printing craftsmen represent a large segment of these employees. They usually specialize in one area of printing operations: type composition, photography, platemaking, presswork, or binding. Their training generally is confined largely to only one of the basic printing methods—letterpress, lithography, or gravure. Some of the principal printing crafts are briefly described below. Detailed information on these crafts is presented in the section on printing occupations, elsewhere in the *Handbook*.

The printing process begins in a composing room where manuscript copy is set in type, proofed, and checked for errors. Machine and handset type and other materials such as photoengravings are assembled there and prepared for the pressroom.

In 1972, about 40 percent of all printing craftsmen—170,000—were employed in composing room occupations. This group includes *compositors* (D.O.T. 973.381) who set type by hand or machine; *typesetter perforator operator* (D.O.T. 208.588) who punch tapes used to operate some typesetting machines; *bankmen* (D.O.T. 973.381) who assemble type in shallow trays called "galleys" and make trial copy of this type; *proofreaders* (D.O.T. 209.688) who check the trial copy with the original copy for errors; and *make-up men* (D.O.T. 973.381) who assemble type and photoengravings.

Electrotypers and stereotypers (D.O.T. 974.381 and 975.782) make duplicate press plates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly in newspaper work.

Photoengravers (D.O.T. 971.381) make metal printing plates of illustrations and other copy that cannot be set up in type. The printing surfaces on these plates stand out in relief above the nonprinting spaces, as do the letters and the accompanying type. Similarly, *gravure photoengravers* (D.O.T. 971.381), a specialized type of photoengraver, make gravure plates in which the image is etched below the surface for use in reproducing pictures and type.

The actual printing operation is performed in the pressroom. *Printing pressmen* (D.O.T. 651.782, .885 and .886) "makeready" (prepare) type forms and press plates for final printing and tend the presses while they are in operation. Small commercial shops generally have small and relatively simple presses that often are fed paper by hand. At the other extreme are the enormous presses used by the larger newspaper, magazine, and book printing plants. They automatically print the paper and cut, assemble, and fold the pages. These machines are operated by crews of pressmen assisted by less skilled workers.

Lithography (offset printing) is growing in importance. Practically all items printed by other processes also can be produced by lithography. Lithography is a process of photographing the matter to be printed, making a printing plate from the photograph and pressing the inked plate against a rubber blanket which in turn presses it onto the paper. Several operations are involved in lithography, and each is performed by a specialized group of workers. The main group of lithographic workers are *cameramen* (D.O.T. 972.382), *artists and letterers* (D.O.T. 971.281), *strippers* (D.O.T. 971.381), *platemakers* (D.O.T. 972.381), and *pressmen* (D.O.T. 651.885).

Because of the increasingly complex and highly mechanized printing equipment in use today, the need is growing for technically trained people in all areas of printing management and production. For example, an increasing number of *production technicians* (D.O.T. 019.281) are employed to see that the standards for each printing job are met.

Many printed items, such as books, magazines, pamphlets, business forms, and calendars, must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled bookbinders. In many binderies, however, the work is done mostly by semiskilled assemblers.

Besides printing craftsmen, the industry employs people in a variety of other occupations. Many mailroom workers are employed in newspapers and magazine plants to address, bundle, and tie the printed matter for distribution. Modern mailroom processes are mechanized to a considerable extent. Mailers operate addressing, stamping, stacking, bundling, and tying machines. Many large printing firms employ mechanics and machinists to repair and adjust typesetting machines, printing presses, and other equipment.

Printing firms employ a great many people as executives, salesmen, accountants, engineers, computer programers, stenographers, clerks, and laborers. Newspapers and other publishers employ a considerable number of reporters, editors, and photographers. These occupations are discussed elsewhere in the *Handbook*.

Training and Other Qualifications

Most training authorities recommend apprenticeship as the best way to learn printing trades. A substantial number of people, however, learn these trades by working as helpers or through a combination of work experience and schooling.

Printing apprenticeships usually last from 4 to 6 years, depending on the occupation and shop or area practices. The apprenticeship programs cover all phases of a particular trade and generally include classroom or correspondence study in related technical subjects and on-the-job training. Apprenticeship applicants generally are required to be between 18 and 30 years of age and must pass a physical examination. However, in many printing crafts there is no maximum age limit for applicants.

Most employers prefer applicants to have a high school education or its equivalent. A thorough knowledge of spelling, punctuation, the fundamentals of grammar, and basic mathematics is essential in many of the printing trades. A knowledge of the basic principles of chemistry, electronics, and physics is becoming increasingly important because of the growing use of photomechanical and electronic processes in printing. An artistic sense also is an asset since the finished product should be pleasing in balance and design. Most printing crafts require people with good eyesight, about average physical strength, and a high degree of manual dexterity. Mental alertness, patience, and the ability to work with others are also necessary. The ability to distinguish colors is important in areas of printing where color is used. Many employers require applicants to take one or more aptitude tests developed for printing occupations. Apprentices often are chosen from among the young people already employed in various unskilled jobs in printing plants.

About 4,000 schools—high schools, vocational schools, technical institutes, and colleges—offer courses in printing. These courses may help a young person to be selected for apprenticeships or other job openings in the printing and publishing industry.

Administrative jobs are usually filled by upgrading experienced people. Many owners and production managers of printing firms have come from the ranks of printing craftsmen. In recent years, however, more firms are filling administrative positions with people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. Most firms hire clerks, bookkeepers, stenographers, and typists who have completed commercial courses in high school or business school.

Although many computer programmers in the printing industry have technical school training, many learn their skills on the job. Also, many compositors and typesetters are being taught computer programming skills, and the International Typographic Union has established a training center for this purpose.

Employment Outlook

Employment in the printing and publishing industry is expected to grow moderately through the mid-1980's. In addition to the job openings that will result from employment growth, many openings will occur from the need to replace experienced workers who retire, die, or transfer to other industries.

The volume of printed material is expected to increase rapidly because of population growth, the increasingly high literacy level of the population, and the trend to greater use of printed materials for information, packaging, and various industrial and commercial purposes. Employment will grow at a slower rate than the volume of printing, however, because of laborsaving technological changes in printing methods.

Occupational groups in the industry are expected to increase at different rates. Employment of administrative, technical, maintenance, and clerical workers will increase at a faster pace than total employment. Employment growth will vary among the printing crafts. The number of lithographic craftsmen, for example, is expected to increase because of the growing use of lithography. On the other hand, since lithography does not require photoengraving, employment of photoengravers is expected to decline. The trend to computerization of typesetting operations will reduce the need for some machine operators in composing rooms while creating a demand for more computer programers. More mechanics will be hired to maintain the industry's increasingly complex machinery.

Earnings and Working Conditions

Earnings of production workers in the printing and publishing industry, including unskilled and semiskilled workers and printing craftsmen, are among the highest in manufacturing. In 1972 production workers in this industry averaged $4.48 an hour, while those in manufacturing industries as a whole averaged $3.81.

The accompanying tabulation shows the average union minimum hourly rates for selected printing occupations in 1972 based on a survey of 69 large cities. These are the minimum basic rates for daywork, and do not include overtime, other special payments, or bonuses.

Most printing craftsmen who are covered by union contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35 to 37-1/2 hour range. Time and a half generally is paid for overtime. Work on Sundays and holidays is paid for at time and one-half or doubletime rates in most commercial printing firms. In newspaper plants, however, the craftsmen's workweek often includes Sundays. Time and one-half or double time is paid for these days only when they are not part of the employee's regular shift. Night-shift workers generally receive pay differentials above the standard day rates.

The starting wage rates of apprentices are generally from 40 to 50 percent of the basic rate for journeymen in the shop. Wages are increased periodically, usually every 6 months, until the apprentice reaches the journeyman rate.

	Average minimum hourly rate July 1, 1972	
	Newspaper	*Book and job shops*
Bookbinders	—	$ 5.86
Compositors:		
Hand	$ 5.94	6.06
Machine operators	6.06	5.99
Electrotypers	—	5.58
Photoengravers	6.46	—
Pressmen (journeymen)	5.80	—
Pressmen (cylinder)	—	5.92
Pressmen (platen)	—	5.49
Stereotypers	5.72	5.85
Mailers	5.55	—

Most employers provide paid vacation ranging from 1 to 4 weeks, depending on the employee's length of service. Other benefits, such as paid holidays, retirement plans, and life and health insurance, also are common.

The injury-frequency rate in the printing industry is somewhat lower than the average for all manufacturing industries.

A large proportion of the printing trades workers are members of unions affiliated with the AFL-CIO. The largest printing trades unions are the Graphic Arts Union, the International Printing Pressmen and Assistants' Union of North America, the International Typographical Union, and the Lithographers and Photoengravers Union. Other printing trades unions include the International Brotherhood of Bookbinders, the International Stereotypers' and Electrotypers' Union of North America, and the International Mailers Union (Ind.). Most unionized lithographic workers are in plants under contract with the Graphic Arts Union, which includes both printing craftsmen and other lithographic workers.

Sources of Additional Information

Details about employment opportunities and apprenticeships may be obtained from local employers, such as newspapers and printing shops, local offices of the unions mentioned above, or the local office of State employment services. Some State employment service offices screen applicants and give aptitude tests.

General information on the printing industry may be obtained from the following organizations:

American Newspaper Publishers Association, 750 Third Ave., New York, N.Y. 10017.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Gravure Technical Institute, 60 East 42d St., New York, N.Y. 10020.

International Typographical Union, P.O. Box 157, Colorado Springs, Colo. 80901.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22201.

(See the section on Printing Occupations elsewhere in the *Handbook* for names of labor organizations and trade associations that can provide more information on specific printing trades.)

TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES

The transportation, communications, and public utility industries produce most of the energy that powers, heats, and lights our factories and homes. The transportation industry moves goods and people by air, rail, water, and highway; the communications industry provides communications systems such as telephones and radio and TV broadcasting. Other public utilities supply the Nation with electricity, gas, and sanitation services.

Transportation, communications, and public utility firms are semipublic in character. Some State and local governments operate their own transit lines or electric companies as well as other types of utilities. Privately owned transportation and public utility firms are regulated closely by commissions or by other public authorities to make sure they operate in the public interest.

In 1972, 4.5 million people worked in the transportation, communications, and public utility industry group. In addition, more than one-half million persons held jobs with State and local governments in publicly owned transit and utility systems. Almost half of the workers in this major industry group worked in two industries: the communications industry, with 1.1 million workers (including telephone, telegraph, and radio and TV broadcasting); and the motor freight industry, with 1 million workers (including local and long-distance trucking). Electric, gas, and sanitary services companies employed about 720,000 workers and railroads about 575,000. Other industries employing a significant number of workers were air transportation and local and interurban passenger transit. The remaining workers were employed by firms that provide water and pipeline transportation and transportation services.

As shown in the accompanying tabulation, blue-collar workers made up 60 percent of all workers in the transportation, communications, and public utility industry group in 1972. Operatives alone accounted for 26 percent of the total. Most of these semiskilled workers are truck, bus, and taxi drivers, and railroad brakemen and switchmen. Craftsmen, foremen, and kindred workers made up another 22 percent. Among the major occupations in this group are airplane mechanic, motor vehicle mechanic, telephone lineman, and locomotive engineer. Another 9 percent were laborers, such as material handlers and truckdrivers' helpers.

Forty percent of the industry group's employees were white-collar workers, mostly in clerical occupations such as telephone operator, ticket agent, secretary, and bookkeeper. Eight percent of all employees were managerial workers, and 7 percent were professional and technical workers. Many of the professional and technical workers are in the communications industry, where, in addition to large numbers of engineers and technicians, many actors, entertainers, and writers are employed.

Major occupational group	*Percent of workers*
All workers	100
White-collar workers	40
Professional, technical, and kindred workers	7
Managers, officials, and proprietors	8
Clerical and kindred workers	24
Sales workers	1
Blue-collar workers	60
Craftsmen, foremen, and kindred workers	22
Operatives and kindred workers	26
Service workers	3
Laborers	9

Employment in the transportation, communications, and public utility industry group is expected to increase slowly through the mid-1980's. In addition to openings resulting from growth, many thousands of jobs will be available each year because of the need to replace workers who die or retire. Transfers of employees to other industries will provide still more opportunities.

Employment growth in individual industries will vary significantly. Increasing popularity of air transportation for both passengers and cargo will spur continued rapid employment growth in this area. Rising population, business expansion, and growth of suburbs will stimulate employment in trucking. On the other hand, little employment change is expected in local and interurban passenger transportation (buses, taxis, and subways) because consumers probably will continue to rely heavily on private automobiles. The long run decline in railroad employment is expected to continue, but at a decreasing rate.

Employment in communications is expected to grow slowly through the mid-1980's. Although demand for the industry's services will increase rapidly, advances in technology are expected to limit employment growth, particularly in telephone communications. Computers and other electronic equipment are expected to be applied increasingly to work previously done by wage earners. Employment in electric and gas utilities also will be affected strongly by advancing technology and will grow slowly despite rapid increases in output.

The statements that follow cover major industries in the transportation, communications, and public utility fields. More detailed information about particular occupations in these fields appears elsewhere in the *Handbook*.

CIVIL AVIATION

The rapid development of air transportation has increased the mobility of the population and has created many thousands of job opportunities in the civil aviation industry. In 1972 about 500,000 people were employed in a variety of interesting and responsible occupations in this industry.

Characteristics of the Industry

Many different organizations and many different activities are grouped in civil aviation. The most familiar are airlines that provide transportation for passengers and cargo. Airlines account for more than three times as much intercity passenger travel as buses and railroads combined.

The civil aviation industry also includes other kinds of flying, as well as government licensed aircraft repair shops. Many businesses transport executives in company planes. Some firms use their own planes for crop dusting, inspecting pipelines, and other activities.

The regulatory and accident investigation functions of the Federal Aviation Administration (FAA), the Civil Aeronautics Board (CAB), and the National Transportation Safety Board (NTSB)—all part of the Federal government, are another part of civil aviation. The FAA develops air safety regulations, coordinates flights, operates ground navigation equipment, and licenses personnel such as pilots, dispatchers, and aircraft mechanics. The CAB makes policy on matters such as airline rates and routes. The NTSB investigates aircraft accidents.

In 1972, about 360,000 civil aviation employees worked for domestic airlines. In addition, several thousand were employed in the United States by foreign airlines that serve this country. Most of the remaining civil aviation employees worked for firms that fly and maintain their own aircraft and for firms that repair aircraft. Others worked for the Federal Government. In 1972, the FAA employed about 52,000 people, and the CAB about 650.

About half of all airline employees work at airports near New York, Miami, Chicago, Los Angeles, San Francisco, and Dallas, the cities where major airlines are based. Others work at similar airports scattered throughout the country. Most other civil aviation employees work near cities although some are employed in small communities.

Civil Aviation Occupations

About four-fifths of all civil aviation employees work in ground occupations. Many of these are mechanics and aircraft maintenance personnel. These workers refuel, clean, inspect, and repair the planes between flights. Other large groups make reservations and sell tickets for the airline companies. Some are air traffic controllers and flight service specialists for the Federal Aviation Administration. Other ground workers included cargo and freight handlers, and clerical, administrative, and professional personnel.

Flight crew members make up the remaining one-fifth of civil aviation employment. They include the pilots, copilots and flight engineers who fly the planes and the flight attendants who assist passengers. Detailed discussions of most of the principal occupations in civil aviation are presented elsewhere in the *Handbook* in the section on Air Transportation Occupations.

Training, Other Qualifications, and Advancement

Jobs are available to young persons with a wide variety of training and backgrounds. Although some jobs require previous training and may require certificates from the Federal Aviation Administration (FAA), others can be learned on the job.

Pilots and copilots usually have an air transport or commercial pilot's certificate from the FAA when they begin work. They also must have an instrument rating to fly when the weather is bad. As a rule, airline pilots and copilots begin as flight engineers.

Young people may obtain pilot training from military or civilian flying schools. Physical requirements are high. With or without glasses, they must have 20/20 vision, good hearing and no physical handicaps that prevent quick reactions. In addition, airlines generally require two years of college and prefer college graduates. Before qualified pilots can fly as a flight engineer, they must obtain a flight engineer's certificate from the FAA.

Although most flight attendants are women, present airline policy permits men and women to compete equally for available jobs. Applicants must be in excellent health, and those who have some college and have experience in dealing with the public are preferred. Applicants are trained for their jobs at company schools.

When hiring aircraft mechanic trainees or apprentices, employers prefer high school or trade school graduates who are in good physical condition. Experience in automotive repairs or other mechanical work also is helpful. Most mechanics remain in the maintenance field, but they may advance to head mechanics, inspectors, and in a few cases, supervisory and executive positions. Some jobs require aircraft mechanics to be certified by the FAA as an airframe mechanic, a power plant mechanic, or both.

New reservation and ticket agents are trained by the company. A good speaking voice and a pleasant personality are necessary, because such personnel deal directly with the public. A high school education is required.

Air traffic controllers are selected through the competitive Federal Civil Service Systems. Applicants must pass a rigid physical examination and a written test. The FAA trains new workers on the job and at the FAA Academy. All workers must be certified by FAA examiners before they can work as controllers. Controllers can advance to the job of chief controller and to higher management jobs in air traffic control.

Completion of commercial courses in high school or business school is usually adequate for entry into general clerical occupations such as secretary or typist. Additional on-the-job training is needed for specialized clerical occupations, such as bookkeeper.

Administrative and sales positions are usually filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad picture of air transportation operations, before they are assigned to a particular department.

Employment Outlook

The total number of workers in civil aviation occupations is expected to increase rapidly through the mid-1980's if fuel shortages do not continue.

Airline employment will increase rapidly as passenger and cargo traffic grow in response to increases in population, income, and business activity. The trend to longer vacations and reduced fares on some domestic and overseas flights also will stimulate passenger traffic. Employment in other civil aviation activities is expected to rise rapidly as more aircraft are purchased for business, agricultural, fire fighting, and recreation purposes.

Employment trends will differ among occupations. Employment of flight attendants and reservation and ticket agents, for example, is expected to grow very rapidly as more people travel by air. On the other hand, air traffic controller employment will grow moderately because new equipment will permit them to direct more planes.

Earnings and Working Conditions

Airline employees earned an average of $13,921 a year in 1972, about twice the average for all nonsupervisory workers in private industry, except farming. Among the major occupations, beginning salaries ranged from $650 a month for ticket agents to $3,000 a month for airline captains.

As a rule, airline employees and their immediate families are entitled to a limited amount of free or reduced-fare transportation on their companies' flights. In addition, they may fly at greatly reduced rates with other airlines.

Airlines operate flights at all hours of the day and night. Personnel in some occupations, therefore, often have irregular hours or work schedules. Maximum hours of work per month for workers in flight occupations have been established by the FAA. Flight personnel may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide living accommodations or pay expenses.

Ground personnel, such as dispatchers and mechanics, usually work a 5-day 40- hour week. Their working hours, however, often include nights, weekends, or holidays. Ground personnel generally receive extra pay for overtime work or an equal amount of time off.

Airline employees usually receive 2 to 4 weeks of vacation with pay, depending upon length of service. They also receive paid sick leave, retirement benefits, and life and health insurance. FAA and other Federal government employees receive 13 to 26 days of annual leave and 13 days of sick leave a year, as well as retirement, life insurance, and health benefits.

Sources of Additional Information

Information about job opportunities in a particular airline may be obtained by writing to the personnel manager of the company. Addresses of companies are available from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

Inquiries about jobs with the FAA should be addressed to the personnel department at the nearest FAA regional office. Addresses of the regional offices are available from:

Personnel Operations Division, Federal Aviation Administration, 800 Independence Ave. SW., Washington, D.C. 20591

Information concerning FAA-approved schools that offer training for aircraft mechanics, pilots, or other technical fields in aviation may be obtained from the Research and Inquiry Division, Office of Information Service AIS-200, Federal Aviation Administration, Washington, D.C. 20591.

OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Electricity has become so much a part of our daily lives that most people take it for granted. But, just imagine not being able to ride the elevator to your apartment and instead having to walk up all those flights of stairs! Or, think about having no lights, televisions, or radios in your home! Today, it would be difficult to get used to living without electricity.

Bringing electricity into our homes and places of work and recreation is not as simply done as just turning on a switch. There are thousands of men and women working in the electric power industry to make all this possible.

Nature and Location of the Industry

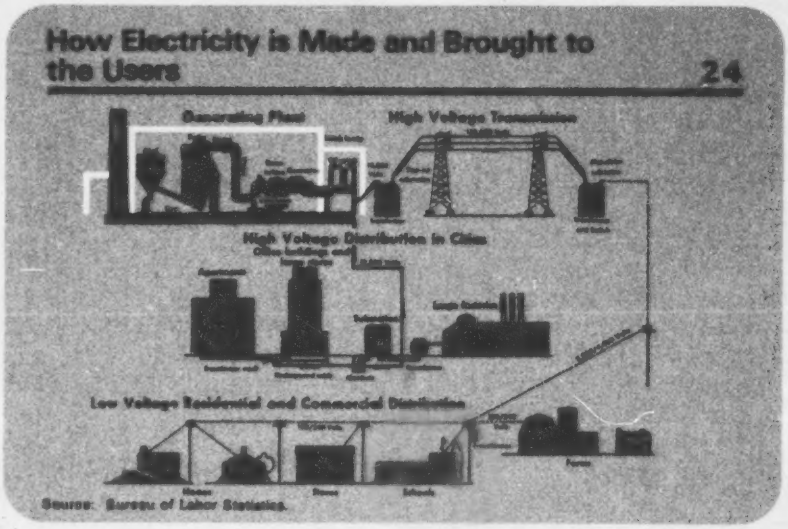
The delivery of electricity to the user at the instant he needs it is the distinctive feature of the operation of electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase his use of electric power at any time by merely flicking a switch, an electric utility system must have sufficient capacity to meet peak consumer needs at any time.

An electric utility system includes power plants that generate electric power, substations that increase or decrease the voltage of the power, and vast networks of transmission and distribution lines. Electric utilities range from large systems serving broad regional areas to small power companies serving individual communities. Most electric utilities are investor-owned (private) or owned by cooperatives; others are owned by cities, counties, and public utility districts, as well as by the Federal Government. While some utilities generate, transmit, and distribute only electricity, others distribute both electricity and gas. This chapter is concerned with employment relating only to the production and distribution of electric power.

Producing and distributing large quantities of electrical energy involves many processes and activities. The accompanying chart shows how electric energy is generated, and how it travels from the generating station to the users. The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants which use coal, gas, or oil for fuel. Some new steam generating stations, however, use nuclear energy. A considerable amount of electricity also is produced in hydroelectric generating stations which use water power to operate the turbines. Some generators, primarily for use in standby service or to provide electricity for special purposes, are powered by diesel engines or combustion turbines.

After electricity is generated, it passes through a "switchyard" where the voltage is increased so that the electricity may travel long distances without excessive loss of power. The electricity passes onto transmission lines that carry it from the generating plant to substations, where the voltage is decreased and passed on to the distribution networks serving individual customers. Transmission lines tie together the generating stations of a single system and also the power facilities of several systems. In this way, power can be interchanged among several utility systems to meet varying demands.

In 1972, 520,000 people worked in the electric power industry. Most of them, 450,000, worked in privately owned utilities and cooperatives and 70,000 worked in Federal and



municipal government utilities. A few large manufacturing establishments, which produce electric power for their own use, also employ electric power workers.

Since electricity reaches almost every locality, jobs in this industry are found throughout the country. Although hydroelectric power projects have created jobs in relatively isolated areas, most utility jobs are still found in heavily populated urban areas, especially where there are many industrial users, or where a large utility has its headquarters.

Electric Utility Occupations. Many different types of workers are required in the electric power industry. About 40 percent of the industry's employees work in occupations related to the generation, transmission, and distribution of electricity, and in customer service occupations. (These occupations are discussed in detail later in this chapter.) The industry also employs large numbers of workers in engineering, scientific, administrative, sales, clerical, and maintenance occupations. A brief discussion on these occupations is given below. Further information can be found in statements covering individual occupations elsewhere in the *Handbook*.

Engineering and Scientific Occupations. Engineers plan generating plant additions, interconnections of complex power systems, and installations of new transmission and distribution equipment. They supervise construction, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In planning modern power systems, engineers help select plant sites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power. They stimulate greater use of electricity by demonstrating the advantages of electrical equipment and suggesting places where electricity can be used more effectively.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping required, electric utilities employ a high proportion of administrative and clerical personnel. Many of these workers are women. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, accounting and auditing clerks, and cashiers are employed. These workers keep records of the services rendered by the company, make up bills for customers, and prepare a variety of statements and statistical reports. An increasing amount of this work in the larger offices now is being performed by the use of electronic data processing equipment. This generally results in more clerical work being done with the same number of employees or even fewer. The use of this equipment also creates requirements for programers and computer operators. Administrative employees include accountants, personnel officers, purchasing agents, and lawyers.

Maintenance Occupations. A considerable number of workers test, maintain, and repair equipment. The duties of these skilled craftsmen are similar to those of maintenance workers in other industries. Among the more important skilled workers are electricians, instrument repairmen, maintenance mechanics, machinists, pipefitters, and boilermakers.

Employment Outlook

Although the production and use of electric power will increase substantially, employment in the industry is expected to grow slowly through the mid-1980's. Most job openings will result from the need to replace workers who retire, die, or leave the industry for other reasons.

All types of consumers will require more and more electricity. The widening use of electric power in industrial processes will spur industry's demand for electricity. At the same time, commercial buyers will need more electricity because of the construction of new store and office buildings, and the modernization of existing ones. Residential customers will increase their use of electric power for heating and air-conditioning and for an increasing number and variety of appliances.

The growing use of automatic controls in this highly mechanized industry, however, will allow sharp increases in electric power production with only minor increases in employment. The number of powerplant and customer service workers should remain approximately at its present level while the number of transmission and distribution workers is expected to increase slightly. There will be many openings for maintenance and repair workers to keep complex machinery in good working order.

Because of the increasing use of electronic data processing equipment for billing and record-keeping, only a small increase in office employment is expected. However, the relatively high turnover in office jobs will provide many openings for new workers each year. Some increase in employment also is expected in administrative jobs; in scientific, engineering, and other technical jobs; and in areas such as sales and market development.

Earnings and Working Conditions

Earnings in the electric utility industry are relatively high. In 1972, nonsupervisory employees in private electric power companies averaged

$4.89 an hour, about one-third more than the average for nonsupervisory workers in private industry as a whole, except farming.

Many nonsupervisory electric utility workers in production, transmission, and distribution departments are union members. The bargaining representative for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers Union of America. Independent unions represent some utility workers.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees work evenings, nights, and weekends. Most union contracts with electric utilities provide a higher rate of pay for evening and night work than the basic day rate.

Overtime work is often required especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report for work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at 1-1/2 times his basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions which affect pay, electric utilities provide other employee benefits. Generally, annual vacations are granted to workers according to length of service. A typical contract or employee benefit program provides for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, and 3 weeks for 10 to 20 years. Some contracts and programs provide for 4 weeks after 18 years, for 5 weeks after 25 years, and 6 weeks after 30 years. The number of paid holidays ranges from 6 to 12 a year. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and generally are paid for in full or in part by the employer.

Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices. This has resulted in an injury rate much lower than in most manufacturing industries. Some occupations, however, are more subject to accidents than others. Accidents occur most frequently among the line—and cable—splicing crews.

Sources of Additional Information

More information about jobs in the electric power industry may be obtained from local electric utility companies, industry trade associations, or from the local offices of unions that have electric utility workers among their membership. Additional information also may be obtained from:

Edison Electric Institute, 750 3d Ave., New York, N.Y. 10017.

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

Utility Workers' Union of America, 1875 Conn. Ave. NW., Washington, D.C. 20006.

POWERPLANT OCCUPATIONS

Nature of the Work

Operators are key workers in a powerplant. They observe, control, and keep records of the operation of various kinds of powerplant equipment. They make sure the equipment functions efficiently and detect any trouble that arises. Operators include four basic classes—boiler, turbine, auxiliary equipment, and switchboard. In many new steam plants, these jobs are combined, and operators and their assistants are known as steam operators, powerplant operators, or central control room operators. Of increasing importance are the maintenance men and repairmen, including electrical, instrument, and mechanical repairmen. Other powerplant workers include helpers and cleaners, and the custodial staff, including janitors and watchmen. Coal handlers are employed in steam generating plants that use coal for fuel. Hydroelectric plants employ gate tenders who open and close the headgates that control the flow of water to the turbines. Supervision of powerplant operations is handled by a chief engineer called an operations supervisor, and by his assistants, the watch engineers (shift supervisors).

Boiler operators (D.O.T. 950.782) regulate the fuel, air, and water supply in the boilers and maintain proper steam pressure needed to turn the turbines, on the basis of information shown by gages, meters, and other instruments mounted on panel boards. One man may operate one or more boilers. Boiler operators are employed only where steam is used to generate electricity.

Turbine operators (D.O.T. 952.138) control the operation of steam- or water-powered turbines that drive the generators. (In small plants, they also may operate auxiliary equipment or a switchboard.) Modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures; therefore, close attention must be given the pressure gauges, thermometers, and other instruments which show the operations of the turbogenerator unit. Turbine operators record the information shown by these instruments and check the oil

pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers that change the steam back into water. They also are responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers and junior operators, assist the turbine operators.

Auxiliary equipment operators (D.O.T. 952.782) check and record the readings of instruments that indicate the operating condition of pumps, fans, blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. Since auxiliary equipment may occasionally break down, these operators must be able to detect trouble quickly, and sometimes make repairs. In small plants which do not employ auxiliary equipment operators, these duties are performed by turbine operators.

Switchboard operators (D.O.T. 952.782) control the amount of electric power flowing from generators to outgoing powerlines by operating switchboards and watching instrument panels. Switches control the movement of electricity through the generating station circuits and onto the transmission lines. Instruments mounted on panelboards show the power demands on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage.

The operators use switches to distribute the power demands among the generators, to combine the current from two or more generators, and to regulate the flow of the electricity onto various powerlines. When power requirements change, they order generators started or stopped and, at the proper time, connect them to the power circuits in the station or disconnect them. In doing this work, they follow telephone orders from the load dispatcher who directs the flow of current throughout the system.

Switchboard operators and their assistants also check their instruments frequently to see that electricity is moving through and out of the powerplant properly, and that correct voltage is being maintained. Among their other duties, they keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

Control Room Operator (D.O.T. 950.782). In most powerplants constructed in recent years, the operation of boilers, turbines, auxiliary equipment, and the switching required for balancing generator output has been centralized in a single control room. Here, central control room operators or power plant operators regulate all the generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants who patrol the plant and check the equipment. Operators report to the plant superintendent or a watch engineer when equipment is not operating properly.

Watch engineers or shift supervisors (D.O.T. 950.131) oversee the employees who operate and maintain boilers, turbines, generators, transformers, and other machinery and equipment. Watch engineers are supervised by a chief engineer or a plant superintendent who is in charge of the entire plant.

Training, Other Qualifications, and Advancement

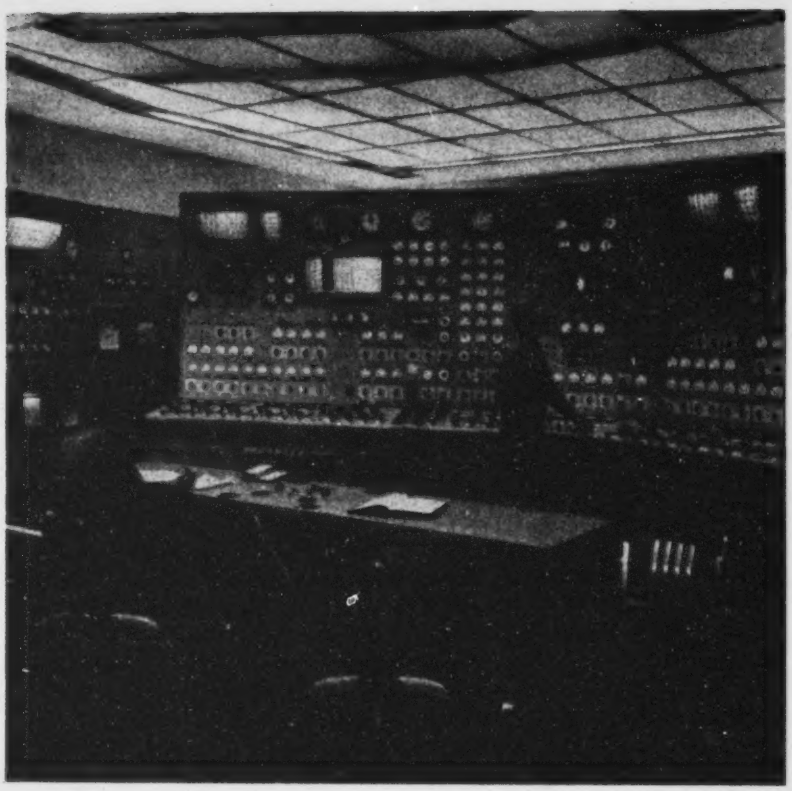
New powerplant workers generally begin at the bottom of the ladder—usually on cleanup jobs. Such work gives beginners an opportunity to become familiar with the equipment and the operations of a powerplant. They advance to the more responsible job of helper, as openings occur. Formal apprenticeships in these jobs are rare. Applicants generally are required to have a high school education or its equivalent.

It takes from 1 to 3 years to become an auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be an auxiliary equipment operator progresses from helper to junior operator to operator. A boiler operator generally spends from 2 to 6 months as a laborer before being promoted to the job of helper. Depending on openings and the worker's aptitude, the helper may advance to junior boiler operator and eventually to boiler operator, or transfer to the maintenance department and work his way up to boiler repairmen. In most large cities, boiler operators, who operate high-pressure boilers, are required to be licensed.

Turbine operators are selected from auxiliary equipment operators in other plants. In most large cities, turbine operators are required to be licensed.

Some powerplant workers employed in atomic-powered electric plants must have special training to work with fissionable, radioactive fuel, in addition to the knowledge and skills required for conventional steam generated electric power.

Where a system has a number of generating plants of different size, operators first get experience in the smaller stations and then are promoted to jobs in the larger stations as vacancies occur. New workers in the switchboard operators section begin as helpers, advance to junior operators, and then to switchboard operators. Some utility companies pro-



Control room workers in generating plant.

mote substation operators to switchboard operating jobs. The duties of both classes of operators have much in common. Switchboard operators can advance to work in the load dispatcher's office.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator are usually required to qualify for a watch engineer's job.

Employment Outlook

The total number of jobs for powerplant operators is expected to show little change through the mid-1980's, although the production of electrical energy will increase at a rapid rate. However, job openings will occur each year because of the need to replace operators who retire, die, or leave the industry for other work.

The use of increasingly larger and more efficient equipment will result in great increases in capacity and production with little increase in the number of powerplant operators. For example, one operator can control a large modern turbogenerator as readily as he can control a much smaller one. Also, the growing use of more automatic equipment reduces the number of operators needed, and makes it possible to direct all operating processes from a central control room. However, because of the expected increased demand for electric power, it will be necessary to build and operate many new generating stations.

Generally, a nuclear-powered plant requires about the same number of employees as a steam-generating plant powered by coal.

Earnings and Working Conditions

The earnings of powerplant workers depend on their types of jobs, the section of the country in which they work, and many other factors. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately owned utilities in 1972.

	Average hourly earnings
Auxiliary equipment operator	$4.23
Boiler operator	5.54
Control room operator	6.15
Switchboard operator:	
Switchboard operator, Class A	5.64
Switchboard operator, Class B	5.24
Turbine operator	5.44
Watch engineer	6.49

A powerplant is typically well-lighted and ventilated, clean, and orderly, but there is some noise from the equipment.

Switchboard operators in the control room often sit at the panel boards, but boiler and turbine operators are almost constantly on their feet. The work of powerplant operators generally is not physically strenuous, particularly in the new powerplants. Since generating stations operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of the Work

One-fifth of the workers in the electric power industry are in transmission and distribution jobs. The principal workers in transmission and distribution jobs are those who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain powerlines—linemen, cable splicers, troublemen, groundmen, and helpers. Linemen make up the largest single occupation in the industry.

Load dispatchers (D.O.T. 950.168), also called system operators or power dispatchers, control the flow of electricity throughout the area served by the utility. The load dispatcher's room is the nerve center of the entire utility system. From this location, he controls the plant equipment used to generate electricity and directs its flow. He telephones instructions to the switchboard operators at the generating plants and the substations. He tells the operators when additional boilers and generators are to be started or stopped so that power production will be in balance with power needs.

The load dispatcher must anticipate demands for electric power so that the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm can cause a million lights to be switched on in a matter of minutes.

He also directs the handling of any emergency situation, such as transformer or transmission line failure, and routes current around the affected area. Load dispatchers also may be in charge of interconnections with other systems and directing transfer of current between systems as the need arises.

The load dispatcher's source of information for the entire transmission system centers in the pilot board. This board, which dominates the load dispatcher's room, is a complete map of the utility's transmission system. It enables the dispatcher to determine, at a glance, the conditions that exist at any point in the system. Lights may show the positions of switches which control generating equipment and transmission circuits, as well as high voltage connections with substations and large industrial customers. The board also may have several recording instruments which make a graphic record of operations for future analysis and study.

Substation operators (D.O.T. 952.782) generally are responsible for the operation of the substation. Under orders from the load dispatcher, they direct the flow of current out of the station by means of a switchboard. Ammeters, voltmeters, and other types of instruments on the switchboard register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by circuit breakers. The substation operators connect or break the flow of current by manipulating switchboard levers that control the circuit breakers. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls converters which perform the change.

In addition to switching duties, the substation operators check the operating condition of all equipment to make sure that it is working properly. They supervise the activities of the other substation employees on the same shift. In smaller substations, the operator may be the only employee.

Some utilities employ a mobile operator who drives from one automatic station to another, inspecting, cleaning up trouble, operating controls, and assisting customers' electricians in large commercial or government installations. Since this job requires considerable independent judgment, the mobile operator is usually more experienced than the substation operator.

Linemen (D.O.T. 821.381) construct and maintain the network of powerlines that carry electricity from generating plants to consumers. Their work consists of installations, equipment replacements, repairs, and routine maintenance. When wires, cables, or poles break, it means an emergency call for a line crew. Linemen splice or replace broken wires and cables and replace broken insulators or other damaged equipment. Most linemen now work from "bucket" trucks with pneumatic lifts that take them to the top of the pole at the touch of a lever.

In some power companies, linemen specialize in particular types of work. Those in one crew may work only on new construction, and others may do only repair work.

Troublemen (D.O.T. 821.281) are experienced linemen who are assigned to special crews that handle emergency calls. They move from one special job to another, as ordered by a central service office which receives reports of line trouble. Often troublemen receive their orders by direct radio communications with the central service office.

These workers must have a thorough knowledge of the company's transmission and distribution network. They first locate and report the source of trouble and then attempt to restore service by making the necessary repairs. Depending on the nature and extent of the problem, a troubleman may restore service in the case of minor failure, or he may simply disconnect and remove

damaged equipment. He must be familiar with all the circuits and switching points so that he can safely disconnect live circuits.

Groundmen (D.O.T. 821.887) dig poleholes and help linemen erect the poles or towers which carry the distribution lines. The linemen bolt crossarms to the poles and bolt or clamp insulators in place on the crossarms. Groundmen then help the linemen raise the wires and cables and install them on the poles by attaching them to the insulators. In addition, with assistance from groundmen, linemen attach a wide variety of equipment to the poles, such as lightning arrestors, transformers, and switches.

Cable splicers (D.O.T. 829.381) install and repair insulated cables on utility poles and towers, as well as those buried underground or those installed in underground conduits. When cables are installed, the cable splicers pull the cable through the conduit and then join the cables at connecting points in the transmission and distribution systems. At each connection in the cable, they wrap insulation around the wiring. They splice the conductors leading away from each junction of the main cable, insulate the splices, and connect the cable sheathing. Most of the physical work in placing new cables or replacing old ones is done by helpers.

Cable splicers spend most of their time repairing and maintaining the cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. When making repairs, they must make sure that the conductors do not become mixed up between the substation and the customer's premises. Cable splicers also make sure the insulation on the cables is in good condition.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from among the experienced switchboard operators and from operators of the large substations. Usually, 7 to 10 years of experience as a senior switchboard or substation operator are required for promotion to load dispatcher. To qualify for this job, an applicant must have knowledge of the entire utility system.

Substation operators generally begin as assistant or junior operators. Advancement to the job of operator in a large substation requires from 3 to 7 years of on-the-job training. About 4 years of on-the-job training is needed to qualify as a skilled lineman. Some companies have formal apprenticeship programs for linemen. Apprenticeship programs combine on-the-job training with classroom instructions in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical energy.

The apprentice usually begins training by helping the groundman set poles in place and by passing tools and equipment up to the lineman. After about 6 months the apprentice begins to do simple linework under close supervision, and progresses to more difficult work as he gains experience. The training of linemen who learn their skills on the job generally is similar to the apprenticeship program; it usually takes about the same length of time, but does not involve classroom instruction. A lineman may advance to troubleman after several years of experience.

Candidates for linework should be strong and in good physical condition because climbing poles and lifting lines and equipment is strenuous work. They also must have steady nerves and good balance to work at the tops of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations through the mid-1980's. Most of these opportunities will occur because of the need to replace experienced workers who retire, die, or transfer to other fields of work.

Some increase in the employment of transmission and distribution workers is expected, although employment trends will differ among the various occupations in this category. In spite of the need to construct and maintain a rapidly growing number of transmission and distribution lines, the number of linemen and troublemen is expected to increase only slightly because of the use of more mechanized equipment. A limited increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for regular substation operators, however, will be reduced substantially, since the introduction of improved and more automatic equipment makes it possible to operate more substations by remote control. At the same time, more mobile substation operators will probably be required.

Earnings and Working Conditions

Wages for transmission and distribution workers vary by occupation and geographic location. The following tabulation shows average hourly earnings for major transmission and distribution occupations in privately owned utilities in 1972.

	Average hourly earnings
Groundman	$4.02
Lineman	5.95
Load dispatcher	6.27
Substation operator	5.32
Troubleman	5.94

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Linemen, troublemen, and groundmen work outdoors and, in emergencies, in all kinds of weather. Cable splicers do most of their work in manholes beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of labor unions, have greatly reduced the hazards of these jobs.

CUSTOMER SERVICE OCCUPATIONS

Nature of the Work

Workers in customer service occupations include people who install, test and repair meters; meter readers; company agents in rural areas; and appliance servicemen.

Metermen (D.O.T. 729.281), or meter repairmen, are the most skilled workers in this group. They install, test, maintain, and repair meters on customers' premises. Some metermen can handle all types of meters, including the more complicated ones used in industrial plants and other places where large quantities of electric power are used. Others specialize in repairing the simpler kinds, like those in homes. Often, some of the large systems require specialists, such as *meter installers* (D.O.T. 821.381) and *meter testers* (D.O.T. 729.281). Installers put in and take out meters. Testers specialize in testing the small meters used in homes and some of the more complicated ones used by commercial and industrial customers.

Meter readers (D.O.T. 239.588) go to customers' premises to check meters which register the amount of electric current used. They record the amount of current used in a specific period so that each customer can be charged for the correct amount. They also watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts which are too small to justify more specialized workers. They collect overdue bills, make minor repairs, and read, connect, and disconnect meters. They receive and send service complaints and reports of line trouble to a central office.

Appliance servicemen are discussed in a separate chapter elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Metermen begin their jobs as helpers in the meter testing and repair departments. Young persons entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become a fully qualified meterman. Some companies have formal apprenticeship programs in which the trainee progresses according to a specific plan.

Inexperienced workers can qualify as meter readers after a few weeks of training. Beginners accompany the experienced meter reader on his

rounds until they have learned the job.

The duties of district representatives are learned on the job. An important qualification for this occupation is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Employment in customer service occupations is expected to show little change through the mid-1980's. The need for meter readers will be limited because of the trend toward less frequent readings. Moreover, automatic meter reading may become more common, and new meters will require less maintenance. However, some job openings for metermen and meter readers will occur each year to replace workers who retire, die, or transfer to other fields of work.

Earnings and Working Conditions

The earnings of customer service workers vary according to the type of job they have and the section of the country in which they work. The following tabulation shows the average hourly earnings for major customer service jobs in privately owned utilities in 1972.

	Average hourly earnings
District representative	$6.09
Meterman A	5.44
Meterman B	4.80
Meter reader	4.32

OCCUPATIONS IN THE MERCHANT MARINE INDUSTRY

In 1972, the merchant marine industry employed about 60,000 people in a variety of occupations that require different levels of skill and education. Many of these jobs are found only in the merchant marine industry.

Nature and Location of the Industry

The merchant marine consists mainly of private firms that carry U.S., foreign, and domestic commerce aboard ocean-going vessels. In late 1972, about 7 out of every 8 of the 703 ships in the active fleet were privately owned. Government-owned ships are operated by the Navy's Military Sealift Command (MSC) and have civilian seafaring personnel.

About 60 percent of the ships in our merchant fleet are freighters, including general cargo ships and special vessels, such as roll-on-roll-off container ships. About 35 percent are tankers that carry liquid products, such as oil, mostly between the Nation's Gulf and Atlantic Coast ports. The few remaining ships are combination passenger-cargo carriers.

Many ships operate on regular schedule to specific ports. Others sail for any port promising cargo. The size of a crew depends on the size and type of vessel. Cargo ships and tankers have crews varying from 36 to 65 men; passenger ships may have 300 or more.

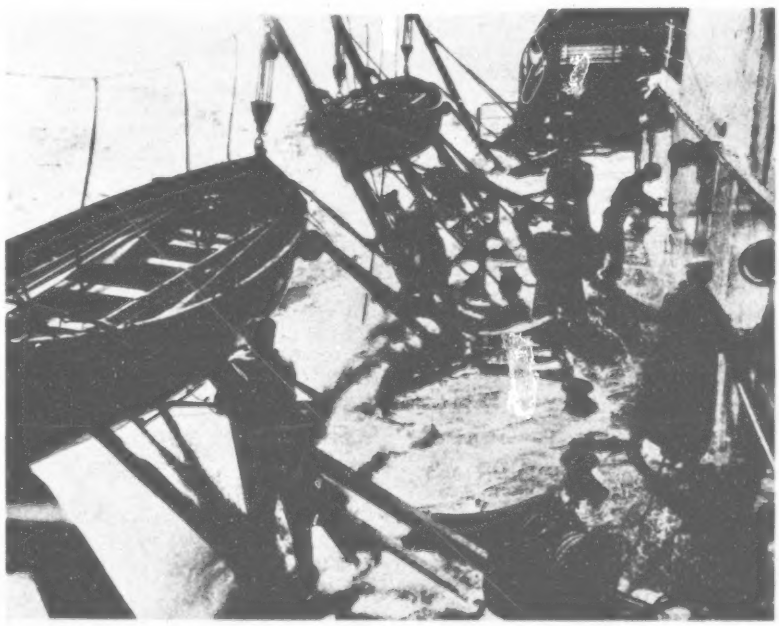
Most shoreside employees in the industry work in the country's major port cities and most officers and seamen have home bases in these cities. The Nation's largest port is New York. Other major Atlantic ports are Philadelphia, Baltimore, Norfolk, Boston, Charleston, Savannah, Tampa, and Jacksonville. Gulf ports that handle large volumes of cargo include New Orleans, Houston, and Galveston. Shipping on the West Coast is concentrated in the areas of San Francisco, Los Angeles, Seattle, and Portland.

Occupations in the Industry

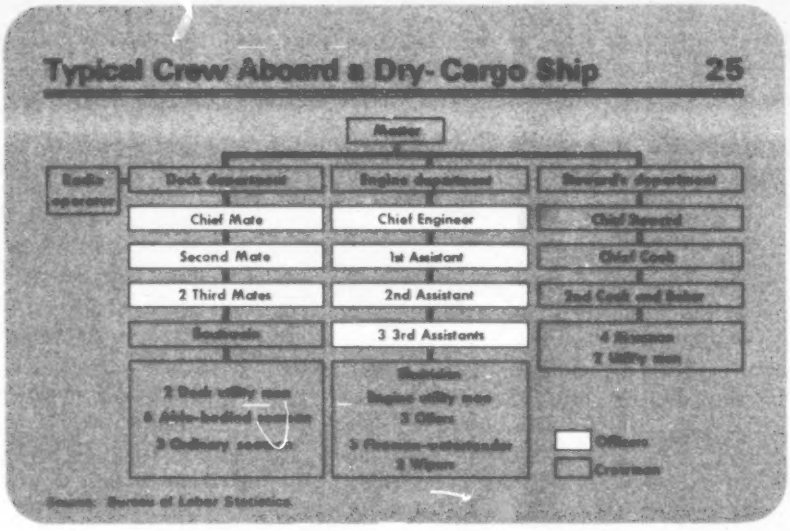
More than half of the merchant marine industry's employees are officers and seamen who make up ship crews. Most of the industry's shoreside employees are dock workers who load and unload ships. A small number of workers have administrative and clerical jobs.

Ship crews. The *captain* (D.O.T. 197.168) or master, has complete authority and responsibility for ship operation, including discipline and order, and the safety of the crew, passengers, and cargo. Under the supervision of the captain, the work aboard ship is divided among the deck, engine, and steward departments.

Deck officers (D.O.T. 197.133), under orders from the captain, direct the navigation of the ship and the maintenance of the deck and hull. *Boatswains* (D.O.T. 911.131) act as foremen-in-charge of deck crews and see that deck officers' orders are carried out. *Able seamen* (D.O.T. 911.887) steer the ship and report sightings to the deck officer. *Ordinary seamen* (D.O.T. 911.887), the entry rating in the deck department,



Men secure gear on the deck of liberty ship in heavy seas.



do general maintenance work such as chipping rust, painting, and splicing and coiling ropes. Deck utilitymen and ship's carpenters also are employed to maintain the ship's deck and hull.

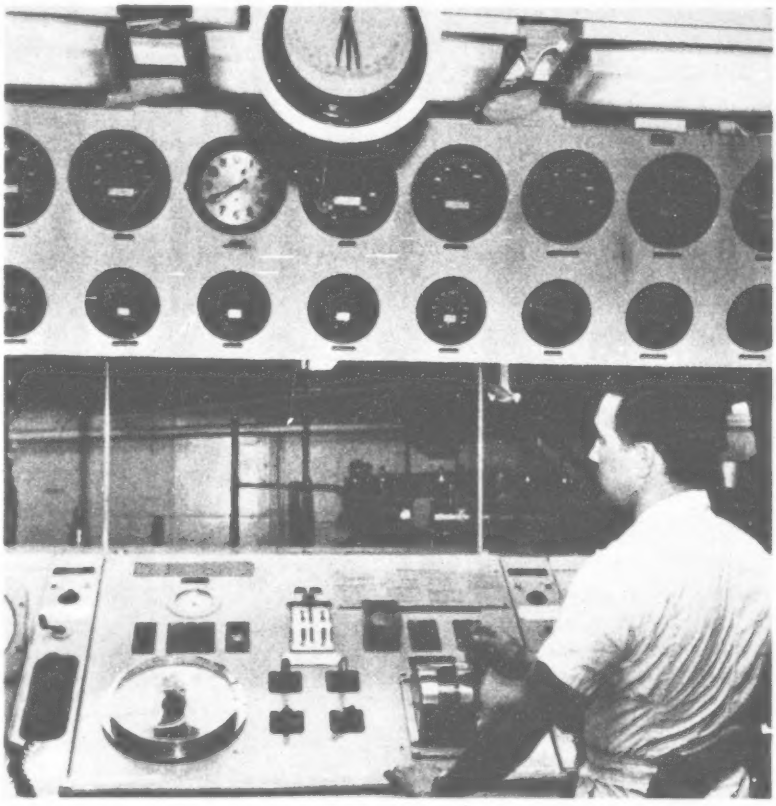
Marine engineers (D.O.T. 197.136) are responsible for starting, stopping, and controlling the speed of the main engines and the operation of all other machinery aboard ships. They also direct seamen, such as oilers and wipers, in the lubrication and maintenance of engines, pumps, and other equipment. *Oilers* (D.O.T. 911.884) lubricate moving parts of mechanical equipment. *Wipers* (D.O.T. 699.887) keep the engine room and machinery clean. *Firemen/watertenders* (D.O.T. 951.885) regulate fuel gauges and the amount of water in the boilers. The ships' *electrician* (D.O.T. 825.281) repairs and maintains electrical equipment, such as generators and motors.

The *chief steward* (D.O.T. 350.138) supervises the preparation of meals and the upkeep of living quarters aboard ship. The *chief cook* (D.O.T. 315.131) and assistant cooks prepare meals. *Utilitymen* (D.O.T. 318.887) carry food supplies from the storeroom, prepare vegetables, and wash cooking utensils. *Messmen* (D.O.T. 350.878) set tables, serve meals, wash dishes, and care for living quarters.

Most ships employ *radio officers* (D.O.T. 193.282), who keep contact with the shore and other ships and maintain the radio equipment. Some cargo ships and all passenger vessels carry *pursers* (D.O.T. 197.168), who prepare the necessary papers to allow ships to enter port.

Occupations aboard ship are discussed in detail elsewhere in the *Handbook* in the statements on merchant marine officers and merchant seamen.

Dock Workers. Many workers are needed to load and unload ships. Stevedores or terminal managers are responsible for the hiring of dock workers called *longshoremen* (D.O.T. 911.883). Dock foremen or gang bosses supervise crews of longshoremen who load and unload ships and move cargo in and out of ware-



houses. Some operate materials handling equipment, such as lift trucks and cranes. Longshoremen also position and fasten hose lines to the ship's tanks when loading or unloading liquid cargo, such as chemicals and oil.

Clerical Occupations. The merchant marine industry employs workers in general clerical jobs, such as payroll clerk, secretary, and typist. Other clerical workers have specialized jobs. *Billing clerks* (D.O.T. 219.388) type invoices that list items shipped and dates of shipment. *Clerks and dispatchers, pilot station* (D.O.T. 911.368) keep records of ships entering ports. *Manifest clerks* (D.O.T. 219.388) compile and type ship's manifest (a list of passengers and cargo) for use at customhouses or terminals. *Receipt and report clerks* (D.O.T. 911.388) prepare reports on labor and equipment costs for loading and unloading cargoes.

Administrative and Professional Occupations. The merchant marine industry employs a small number of administrative and other office personnel. Executives plan and administer company policy. The industry also employs accountants, lawyers, and labor relations and personnel workers. Some *marine architects* (D.O.T. 001.081) are employed to oversee the construction and repair of ships.

Training, Other Qualifications, and Advancement

Inexperienced workers may be hired as longshoremen to load and unload cargo. Applicants must be in good physical condition. A high school education is preferred but not required. Under the guidance of experienced workers, longshoremen can learn their jobs in a few weeks. As vacancies occur, they can advance to jobs such as lift truck operator and crane operator. Workers who have supervisory ability may become dock foremen or gang bosses.

No educational requirements are established for jobs aboard ship, but a good education is an advantage. Formal training for officers is conducted at the U.S. Merchant Marine Academy, at five State merchant marine academies, and through programs operated by trade unions. Unions also conduct training programs to upgrade the ratings of seamen.

To obtain an officer's license, a candidate must be a U.S. citizen, physically fit, and pass a written examination administered by the U.S. Coast Guard. Seamen also must obtain licenses (merchant mariner's document) from the Coast Guard. An applicant must pass a physical examination and present proof that he has a job offer aboard a U.S. merchant vessel.

A young person who is considering a career at sea must be able to live and work with others as a team. Although peace-time service is relaxed, they must adjust to some military-like discipline that is essential because of the nature of shipboard life.

Most general clerical occupations, such as secretary or bookkeeper, usually require the completion of basic commercial courses in high school or business school. Additional on-the-job training is necessary for specialized clerical occupations, such as manifest clerk and receipt and report clerk.

Administrative positions usually are filled by college graduates who have degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. A knowledge of the merchant marine industry is helpful. Marine architects must be licensed professionals. Requirements for licensing are set by the individual States and generally include graduation from an accredited professional school followed by 3 years of practical experience in an architect's office.

Employment Outlook

Employment in the merchant marine industry is expected to decline slowly through the mid-1980's. Nevertheless, some openings will arise each year from the need to replace experienced workers who retire, die, or transfer to other fields. Competion for openings on ships, however, will be intense because the number of people seeking jobs is expected to exceed greatly the number of openings.

Because of substantially higher shipbuilding and labor costs, our merchant fleet finds it difficult to compete in the world shipping market. To insure that our country has a merchant fleet operating in regular or essential trade routes, the Government subsidizes many ships. The Government also passed a law in 1970 to subsidize the construction of 30 new ships annually over a 10-year period and to improve tax incentives for firms to buy new ships. The number of ships built, however, is expected to be about the same as the number of older ones taken out of service. Therefore, the size of our merchant fleet probably will not grow.

Employment of ship's officers and seamen is expected to decline because new ships are larger and faster and can be operated by smaller crews. The greater use of containerized cargo ships and improvements in materials handling equipment will reduce the need for longshoremen. Employment in administrative and clerical occupations, on the other hand, is not expected to change significantly.

Earnings and Working Conditions

Longshoremen working along the Atlantic and Gulf Coasts earned $5.55 an hour in 1972 and those on the Pacific Coast earned $5.10 an hour. Longshoremen also earn extra pay for handling hazardous cargo.

Earnings aboard ships are relatively high; most officers earned a base pay of about $1,150 a month in 1972. Seamen who have advanced a rung or two in rating could receive a base pay of nearly $600 a month. In addition, both officer and seaman earnings are supplemented by premium pay for overtime and assuming extra responsibilities. On the average, additional payments for assuming extra work or responsibility add about 50 percent to base pay. Shipboard workers also receive free meals and lodging while at sea.

Since ship's crew members and longshoremen are subject to occasional layoff, however, their annual earnings usually are not as high as the hourly rates and monthly salaries would imply. Most shoreside workers in the industry have a 5-day, 40-hour workweek. The workweek for people aboard ships is considerably different. At sea, most officers and seamen are required to stand watch, working split shifts around the clock. Generally, they work two 4-hour shifts during every 24-hour period and have 8 hours off between each shift. Some officers and seamen are on duty 8 hours a day, Monday through Friday.

The merchant marine industry provides excellent fringe benefits. Most employers provide paid vacations and holidays. Vacations for seamen and officers range from 90 to 180 days a year. Many firms also provide other benefits such as life, health, and accident insurance. Officers and seamen may retire on full pension after 20 years of service, regardless of age. Longshoremen are eligible for pension at age 65.

Working and living conditions aboard ship have improved over the years. Mechanization has reduced physical demands and newer vessels have private rooms, air-conditioning, television, and better recreational facilities. However, life aboard ship is confining, and since voyages last several weeks or months, officers and seamen are away from home and families much of the time. Some tire of the lengthy separations and choose shoreside employment. However, for many people, the spirit and adventure of the sea, good wages, and fringe benefits more than compensate for the disadvantages.

The duties aboard ship are hazardous compared to other industries. At sea, there is always the possibility of injuries from falls or the danger of fire, collision, or sinking. Most shoreside jobs are not hazardous, but longshoremen may do heavy lifting and risk injury from falling boxes and other freight when loading and unloading ships.

Most employees are union members. All longshoremen are represented by either the Longshoremen's Association International Union or the Longshoremen's and Warehousemen's Union. Most officers aboard ships are represented by the International Organization of Masters, Mates and Pilots; and the National Marine Engineers Beneficial Association. Seamen are members of the National Maritime Union of America and the Seafarers' Union.

Sources of Additional Information

General information about jobs in the merchant marine industry may be obtained from:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings and wages aboard ships can be obtained from local maritime unions. If such a union is not listed in the local telephone directory, information may be obtained from:

National Maritime Union of America, 36 Seventh Ave., New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Ave., Brooklyn, N.Y. 11232.

International Organization of Masters, Mates and Pilots, 39 Broadway, New York, N.Y. 10006.

National Marine Engineers, Beneficial Association, 17 Battery Place, New York, N.Y. 10004.

Further information about longshoremen jobs may be obtained from:

International Longshoremen's Association (AFL-CIO), 17 Battery Place, New York, N.Y. 10004.

International Longshoremen's and Warehousemen's Union (AFL-CIO), 150 Golden Gate Ave., San Francisco, Calif. 94102.

OCCUPATIONS IN RADIO AND TELEVISION BROADCASTING

The glamor and excitement of radio and television make broadcasting careers attractive to many young people. Electronics and the business aspects of broadcasting also are attractions. In 1972 about 108,000 full-time and 25,000 part-time staff were employed in broadcasting; slightly more than half were employed in radio and the rest were in television. In addition, several thousand free-lance performers, such as actors and musicians, work on a contract basis for stations, networks, and other producers. Several thousand other employees work for independent producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials.

Broadcasting stations offer a variety of interesting jobs in all parts of the country. Opportunities for entry jobs are best at stations in small communities, although the highest-paying jobs are in large cities, especially those with national network stations.

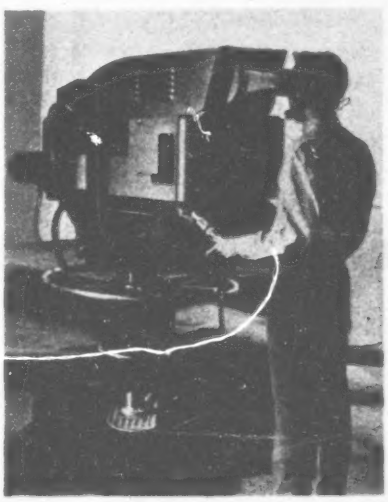
Nature and Location of the Industry

In 1972 about 6,800 commercial radio stations were in operation in the United States. Approximately 4,400 were AM stations and about 2,400 were FM. Commercial television stations numbered about 700 in 1972.

Most commercial radio broadcasting stations are small, independent businesses. The average station employs about 11 full-time and 4 part-time workers. Television stations are generally larger, and average about 75 full-time and 10 part-time employees.

Commercial radio stations are served by seven nationwide networks and a large number of regional networks. Stations can affiliate with networks by agreeing to broadcast their programs on a regular basis. The seven national radio networks employed approximately 2,500 workers in 1972.

Most television stations depend on one of three national television networks for programs that would be too expensive for individual stations to originate—for example, sports events, such as baseball games, or newscasts of national and international significance. These networks, in turn, can offer national coverage to sponsors. Up to 200 stations across the country may carry a network television show. In 1972 the three national networks employed about 17,000 workers, or almost 3 of every 10 staff employees in commercial television. Most network programs originate in New York City and Los Angeles.



In addition to commercial broadcasting stations, there were about 550 educational radio stations (mainly FM) and 200 educational television stations in 1972. These stations are operated principally by educational agencies such as State commissions, local boards of education, colleges and universities, and special community public television organizations. Educational stations employed more than 6,900 full-time and over 3,000 part-time workers in 1972 and accounted for about 1 out of every 14 workers in radio and television broadcasting.

There were also about 2,900 cable TV systems (CATV) serving 6.5 million homes. Cable TV systems employed about 7,000 workers.

Broadcasting Occupations

About half of all employees in the broadcasting industry hold professional and technical jobs, such as staff announcers, newsmen, writers, or broadcast technicians. Clerical and sales workers make up an additional one-fourth, and managerial personnel, such as producers and directors, make up about one-sixth. Many of the remaining employees are craftsmen, such as electricians and carpenters.

Jobs vary greatly between small and large stations. In small stations, the station manager, who frequently is the owner, may act as business and sales manager, or perhaps as program director, announcer, and copywriter. Announcers in small stations may do their own writing, operate

the studio control board, and do sales work. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments. In large radio and television stations, jobs are more specialized and usually confined to one of four departments: programming, technical, sales, or business department. The kinds of jobs found in each of these departments are described in the following paragraphs.

Programming Department. Staff employees produce daily and weekly shows, assign personnel to cover special events, and provide general program services such as sound effects and lighting. In addition to these staff employees, freelance actors, comedians, singers, and other entertainers are hired for specific broadcasts, a series of broadcasts, or for special assignments.

The size of a station's programming department depends on the extent to which its broadcasts are live, recorded, or received from a network. In a small station, a few people make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. In a large station, on the other hand, the program staff may consist of a large number of people in a wide variety of specialized jobs.

Program directors are responsible for the overall program schedules of large stations. They arrange for a combination of programs that will be most effective in meeting the needs of advertisers and at the same time be most attractive and interesting to the audience.

Traffic managers prepare daily schedules of programs and keep records of broadcasting time available for advertising. *Continuity directors* are responsible for the writing and editing of all scripts. They may be assisted by *continuity writers,* who prepare announcers' books ("copy") which contain the script and commercials for each program along with their sequence and length.

Directors plan and supervise individual programs or series of programs. They coordinate the shows, select artists and studio personnel, schedule and conduct rehearsals, and direct on-the-air shows. They may be assisted by *associate directors*, who work out detailed schedules and plans, arrange for distribution of scripts and changes in scripts to the cast, and help direct on-the-air shows. Some stations employ *program assistants* to aid directors and associate directors. Assistants help assemble and coordinate the various parts of the show. They arrange for obtaining props, makeup service, art work, and film slides and assist in timing. They use cue cards prepared from scripts, to cue the performers.

Education and public affairs directors are a link between the station and schools, churches, and civic organizations. They supervise and edit most noncommercial programs.

In large stations, directors may work under the supervision of a *producer* (also called an operations manager), who selects scripts, controls finances, and handles other production problems. Many times these functions are combined in the job of *producer-director.*

Announcers are the largest and best known group of program workers. Announcers introduce programs, guests, and musical selections and deliver most of the live commercial messages. In small stations, they also may do other work, such as operate the control board, sell time, and write commercial and news copy. In large stations, their duties are confined to the programing department. Broadcast announcers are discussed in detail elsewhere in the *Handbook*.

Music is an important part of radio programing. Both small and large stations use recordings and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music libraries, sometimes employ *music librarians* to maintain music files and answer requests for any particular selection of music. The networks have specialized personnel who plan and arrange for musical services. *Musical directors* select, arrange, and direct suitable music for programs on general instructions from program directors. They select musicians for live broadcasts and direct them during rehearsals and broadcasts. Musicians are generally hired on a freelance basis, although a few stations employ staff musicians full time.

News gathering and reporting is a key aspect of radio and television programing. *News directors* plan and supervise the overall news and special events coverage. *Newscasters* broadcast daily news programs and report special news events on the scene. *Newswriters* select and write copy for newscasters to read on the air. In small stations, the jobs of newscaster and newswriter often are combined.

Stations that originate live television shows must have staff members capable of handling staging jobs. *Studio supervisors* plan and supervise the setting up of scenery and props. *Floor* or *stage managers* plan and direct the actors' positions and movements on the set according to directors' instructions. The jobs of studio supervisor and floor manager often are combined. *Floormen* set up props, hold cue cards, and do other unskilled chores. *Makeup artists* prepare personnel for broadcasts by applying cosmetics. *Scenic designers* plan and design settings and

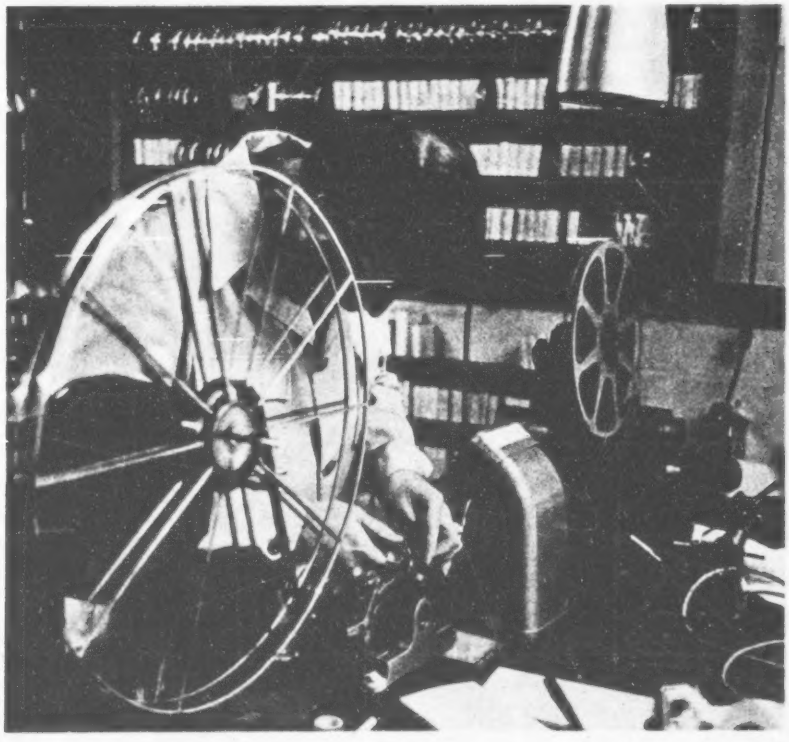
backgrounds for programs. They select furniture, draperies, pictures, and other props to help convey the desired visual impressions. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire or rain.

About half of all commercial television programming is on film, about 15 percent is live, and the remainder is recorded on video tape. Broadcast technicians make video tape recordings on electronic equipment that permits instantaneous playback of a performance. Video tape is used to record live shows and to prerecord programs for future broadcasts. Many stations employ specialized staff members to take care of filmed program material. *Film editors* edit and prepare all film for on-the-air presentation. They screen all films received, cut and splice films to insert commercials, and edit locally produced film. *Film librarians* catalogue and maintain files of motion picture film.

Technical Department. Technical staffs position microphones, adjust levels of sound, keep transmitters operating properly, and move and adjust lights and television cameras to produce clear, well-composed pictures. They also install, maintain, and repair the many types of electrical and electronic equipment required for these operations.

Most stations employ *chief engineers*, who are responsible for all engineering matters, including supervision of technicians. In small stations, they also may work a regular shift at the control board. Large stations have engineers who specialize in fields such as sound recording, maintenance, and lighting. Networks employ a few *development engineers* to design and develop new electronic apparatus to meet special problems.

Broadcast technicians have many jobs. For example, they control the operation of the transmitter to keep the level and frequency of broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations where remote broadcasts are to be made. (Further information on broadcast technicians is given elsewhere in the *Handbook*.)



Film editor cuts and splices film.

Sales Department. Time salesmen, the largest group of workers in this department, sell advertising time to sponsors, advertising agencies, and other buyers. They must have thorough knowledge of the station's operations and the characteristics of the area it serves. The latter includes population, number of radio and television sets in use, income levels, and consumption patterns. Time salesmen in large stations often work closely with sponsors and advertising agencies. Many stations sell a substantial part of their time, particularly to national advertisers, through independent sales agencies.

Large stations generally have several workers who do only sales work. The sales manager supervises a staff of time salesmen, and also may handle a few of the largest accounts personally. Some large stations employ statistical clerks and research personnel to help analyze and report market information on the community served.

Business Management. In a very small station, the owner and his secretary may handle all the recordkeeping, accounting, purchasing, hiring, and other routine office work. If the size of the station warrants full-time specialists, the business staff

Broadcast technician regulating quality of picture.

may include accountants, publicity specialists, personnel workers, and other professional workers. They are assisted by office workers, such as stenographers, typists, bookkeepers, clerks, and messengers.

Training, Other Qualifications, and Advancement

A high school diploma is the minimum educational requirement for most entry jobs in broadcasting, although for many jobs some college training is preferred. A liberal arts education is a good qualification for the beginner because broadcasters need people with knowledge and interests in many areas. Television programming for networks and large independent stations generally requires a college degree and some experience in broadcasting.

Some young people without specialized training or experience get their start in broadcasting in jobs such as clerk, typist, floorman, or assistant to an experienced worker. As these new workers gain knowledge and experience, they have the chance to advance to more responsible jobs. A few young people get started in broadcasting with temporary jobs in the summer when regular workers go on vacations and broadcast schedules of daylight hours stations are increased.

Technical training in electronics is required for entry jobs in engineering departments. In addition, anyone who operates or adjusts a broadcast transmitter must have a Federal Communications Commission (FCC) Radiotelephone First Class Operator License. To obtain this license, an applicant must pass a series of technical examinations given by the FCC. Small radio stations with only a few employees sometimes prefer to have as many personnel as possible legally qualified to operate their transmitters. Because of this, nontechnicians, especially announcers, have a better chance of getting a job in radio if they have a first class license. A course in electronics at a recognized technical institute is probably the best way to prepare for the FCC test.

Entry jobs as announcers in small stations usually do not require specific training or experience, but an applicant must have a good voice, a broad cultural background, and other characteristics that make a dramatic or attractive personality. Qualifications for administrative and sales jobs in broadcasting are similar to those required by other employers; a business course of study in high school or college is good preparation for such jobs.

Most beginners start out in small stations. Although these stations cannot pay high salaries, they offer opportunities to learn the different phases of broadcasting work because they generally use personnel in combination jobs. For example, an announcer may perform some of the duties of a broadcast technician.

People in the technical department tend to remain in this area of work, where thorough training in electronics is essential. Program employees usually remain in programming work, although sometimes transfers to and from the sales and business departments are made. Transfers are easier between sales and business departments because of their close working relationship; in fact, in the small stations, they are often merged into one department. Although transfers of experienced workers between departments are limited to the extent noted, these distinctions are less important in beginning and top-level jobs. At the higher levels, a station executive may be drawn from top-level personnel of any department.

Employment Outlook

Employment in the broadcasting industry is expected to grow moderately through the mid-1980's. Most job openings, however, will result from the need to replace experienced workers who retire, die, or leave the industry for other reasons. Competition will be very keen for entry jobs, especially in the large cities, because of the attraction this field has for young people, and the relatively few beginning jobs that will be available.

New radio stations are expected to open, particularly in small communities, and will offer opportunities for some additional workers. In existing radio stations, however, technological developments will limit employment growth. Equipment to control transmitters from the studio will eliminate the need for a technical crew at the transmitter site, and automatic programming equipment permits radio stations to provide virtually unattended programming.

The number of educational television stations is expected to increase as private and government groups continue to expand in this

area. The growth of educational stations will increase job opportunities, especially in programming, engineering, and station management.

Cable television (CATV) has emerged as a powerful new force in communications, and some additional job opportunites for professional, technical, and maintenance workers will be created as CATV systems increasingly originate and transmit programs. By using cables instead of airwaves, CATV can offer customers a larger selection of stations plus many additional programs produced specifically for cable television.

Earnings and Working Conditions

In 1972 earnings of nonsupervisory broadcasting workers averaged $4.47 an hour, nearly one-fourth more than the average for nonsupervisory workers in all private industries, except farming. Salaries range widely among occupations and locations in the broadcasting industry. Employees in large cities generally earn much more than those in the same kinds of jobs in small towns. Wages also tend to be higher in large stations than in small ones, and higher in television than in radio.

Most full-time broadcasting employees have a scheduled 40-hour workweek; employees in many small stations work longer hours. Sales and business employees generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, weekends, and holidays. To meet a broadcast deadline, program and technical employees in the networks may have to work continuously for many hours under great pressure.

Many unions operate in the broadcasting field. They are most active in the network centers and large stations in metropolitan areas. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts, such as stagehands, sound and lighting technicians, wardrobe attendants, makeup men, and cameramen. Many announcers and entertainers are members of the American Federation of Television and Radio Artists. The Directors Guild of America, Inc. (Ind.) organizes program directors, associate directors, and stage managers. The Screen Actors Guild, Inc., represents the majority of entertainers who appear on films made for television.

Sources of Additional Information

General information about careers in radio and television broadcasting is available from:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

Information about college courses in television broadcasting is available from:

Executive Secretary, Association for Professional Broadcasting, National Association of Broadcasting, 1771 N St. NW., Washington, D.C. 20036.

General information about careers in public radio and television broadcasting is available from:

Corporation for Public Broadcasting, 888 16th St. NW., Washington, D.C. 20006.

OCCUPATIONS IN THE RAILROAD INDUSTRY

The railroads, with their network of more than 200,000 miles of tracks reach into all parts of the country. Trains link people with goods and large communities with small.

With about 575,000 workers in 1972, the railroads were one of the Nation's largest employers and the second largest transportation industry. Railroad workers operate trains, build and repair equipment and facilities, and provide services to customers. In most of these jobs, workers start at the bottom and work their way up by learning their jobs and proving their abilities.

Nature and Location of the Industry

The railroad industry is made up of "line-haul" railroad companies that transport freight and passengers, and switching and terminal companies that operate in some large cities.

About 93 percent of all railroad employees work for line-haul companies that handle about 99 percent of the industry's business. The remainder work for short-line railways and switching and terminal companies. Most railroad revenue and employment comes from freight. Passenger service, though important, has declined substantially in the past 30 years.

Although railroad workers are employed in every State except Hawaii and in communities of all sizes, the greatest number work at terminal points where the railroads have central offices, yards, and maintenance and repair shops. The hub of the Nation's railroad network is Chicago where the large eastern and western railroad systems meet. Large numbers of railroad employees also work in and near New York, Los Angeles, Pittsburgh, Cleveland, and St. Louis.

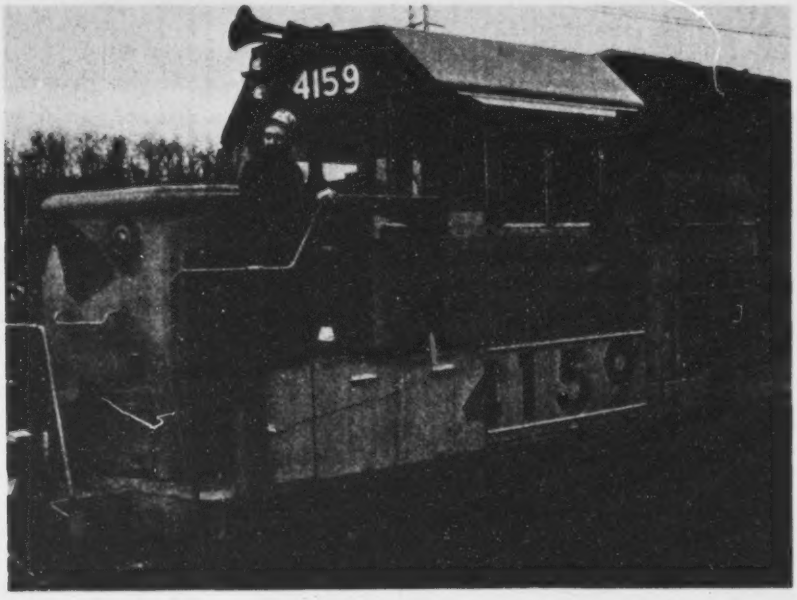
Railroad Occupations

Railroad workers can be divided into five main groups: operating employees; communications, station, and office workers; equipment maintenance workers; property maintenance workers; and passenger service attendants.

Operating employees make up almost one-third of all railroad workers. Included are locomotive engineers, firemen, conductors, brakemen, and, on some passenger trains, baggagemen. Whether on the road or at terminals and railroad yards, they work together as train crews. Switchtenders help conductors and brakemen by throwing switches. Hostlers fuel, check, and deliver locomotives from the engine house to the crew.

Another one-fourth of all railroad workers are *communications, station, and office employees* who control train movements and handle the railroads' business affairs. Telegraphers, telephoners, and towermen pass on orders and other instructions to train crews and set signals and track switches. Agents manage business affairs of the railroad stations. Railroad clerks assist station agents, do secretarial and other office work, and handle reservations and ticket sales. In small stations, they may tend baggage rooms. Other workers in this group are claims investigators, accountants, lawyers, and watchmen.

More than one-fifth of all rail-



road employees are *equipment maintenance workers*, who service and repair locomotives and cars. Included are carmen, machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.

Property maintenance workers, who make up about one-sixth of all railroad employees, build and repair tracks, tunnels, signals, and other railroad property. Trackmen and other maintenance-of-way workers repair tracks and roadbeds. Bridge and building workers construct and repair bridges, tunnels, and other structures along the company's right-of-way. Signal workers install and service the railroads' vast network of signals, including highway crossing protection devices.

The remaining and smallest group of railroad workers are *passenger service attendants*, who take care of passengers on trains. Included in this group are porters, cooks, and waiters.

Chart 26 shows the number of workers in major railroad occupations in 1972. Detailed information about these occupations is given elsewhere in the *Handbook*.

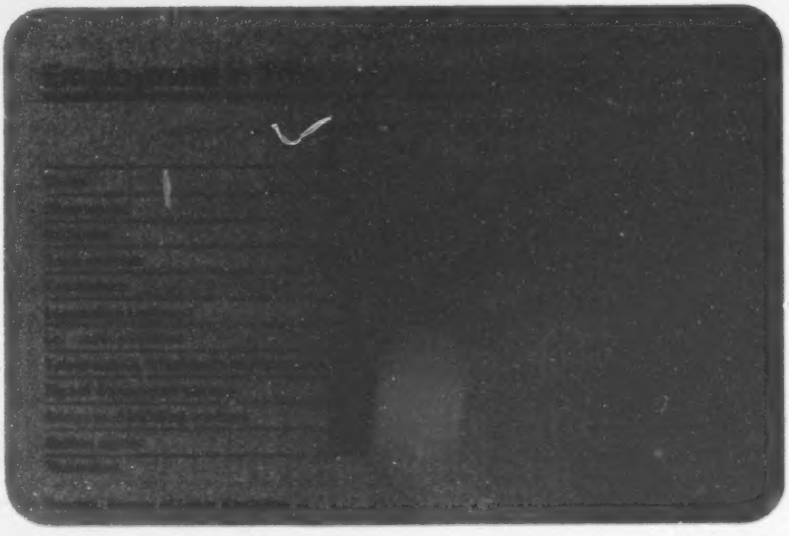
Training, Other Qualifications, and Advancement

Most beginning railroad workers are trained on the job by experienced employees. Training for some office and maintenance jobs is available in high schools and vocational schools. Universities and technical schools offer courses in accounting, engineering, traffic management, transportation, and other subjects valuable to professional and technical workers.

New employees in some operating service occupations start as extra board workers. Their names are placed on lists for individual occupations, and they substitute for regular workers who are on vacation, ill, or absent for other reasons. They also may be called when railroad traffic increases temporarily or seasonally.

Experienced extra board workers with sufficient seniority move to regular assignments as they become available. The length of time on the extra board varies by type of job and number of available openings. Some workers do not receive regular assignments for many years.

Beginners in shop trades are usually high school graduates with no previous experience, although some shop laborers and helpers are promoted to the trades. All except electrical workers serve apprenticeships that last 3 years for inexperienced



workers and 2 years for helpers. Inexperienced electrician apprentices serve 4 year apprenticeships, and helpers serve 3 years.

Most applicants for railroad jobs must pass physical examinations and those interested in train crew jobs need excellent hearing and eyesight. Color-blind persons are not hired as locomotive engineers or brakemen or for any other jobs that involve interpreting railroad signals.

Railroad workers are promoted on the basis of seniority and ability. Job openings are posted on bulletin boards and workers may bid for them. The worker highest on the seniority list usually gets the job. To be promoted, however, workers may have to qualify by passing written, oral, and practical tests. Advancement in train and engine jobs is along established lines. Most locomotive engineers, for example, are chosen from qualified firemen. Some railroads promote brakemen to engineer positions.

Besides determining advancement procedures, seniority also gives workers some choice of working conditions. A telegrapher, for instance, may have to work several years on the night shift at out-of-the-way locations before finally getting a day shift assignment near home.

Employment Outlook

The long run decline in railroad employment is expected to continue through the mid-1980's, but at a decreasing rate. Nevertheless, thousands of job opportunities will develop each year as the industry replaces some experienced workers who retire, die, or transfer to other fields of work.

Despite an expected increase in freight traffic, railroad employment will decline mainly as a result of increased worker productivity due to technological innovations. For example, more powerful diesel locomotives pull longer trains and decrease the number of train crews needed to move the same amount of freight. Roadway maintenance machines take the place of workers with handtools. Automatic switching lowers the number of conductors and brakemen required, and automatic signaling equipment increases the productivity of telephoners, telegraphers, and towermen.

Most people working in passenger service may eventually work for AMTRAK, the National Railroad Passenger Corporation, created in 1971 to revive passenger service trains. However, it will take years to carry out the AMTRAK program and it is too early to determine its effect on these jobs.

Earnings and Working Conditions

Nonsupervisory employees of line-haul railroads averaged $4.94 an hour in 1972, about one-third higher than the average for nonsupervisory workers in all private industries, except farming. Earnings of railroad workers vary widely, however, depending on occupation. In 1972, for example, average hourly earnings for locomotive engineers in passenger service were $9.25; for freight service brakemen, $5.98; for railway clerks, $4.78; and for track gang members, $4. Regional wage differences are much less in railroading than in other industries because of nationally negotiated labor contracts.

Most railroad employees work a 5-day, 40-hour week, and receive premium pay for overtime. Operating employees, station agents, and telegraphers and telephoners often work nights, weekends, and holidays. Extra board workers may be called at any time. Bridge and building workers, signal installers, and trackmen may work away from home for days at a time.

Employees are usually paid for 9 holidays a year, and depending on length of service, receive 1 to 5 weeks of paid vacation a year.

Federal laws provide retirement pensions for railroad workers who are age 65 and have at least 10 years of service. Workers with between 10 and 30 years of service may retire with a reduced pension at age 62. Other benefits include pensions for disabled workers, unemployment compensation, and pay for workdays lost due to sickness or injury.

Other insurance programs are operated under agreements with labor organizations. These provide group life insurance to employees and comprehensive hospital and medical insurance to employees and their dependents.

Sources of Additional Information

Additional information about occupations in the railroad industry may be obtained from local railroad offices. General information about the industry can be obtained from:

Association of American Railroads, American Railroads Building, 1920 L St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE TELEPHONE INDUSTRY

About 590 million local and long-distance telephone calls are made daily in the United States and overseas. In 1972, approximately 960,000 employees were required to provide this service.

The telephone industry offers men and women steady, year-round work in many different jobs. Some jobs, such as telephone operator and file clerk, can be learned in a few weeks; others, such as installer and repairman, require many months.

More than half of all telephone workers are women.

Nature and Location of the Industry

Providing telephone service for the many millions of residential, commercial, and industrial customers is the main work of the Nation's telephone companies. More than 125 million telephones were in use in the United States in 1972.

Telephone jobs are found in almost every community. Most telephone workers, however, are employed in cities which have large concentrations of industrial and business establishments. The nerve center of the local telephone system is the central office that has the switching equipment through which a telephone may be connected with any other telephone. Every call travels from the caller through wires or micro-wave radio and cables to the cable vault in the central office. Thousands of pairs of wires fan out from the cable vault to a distributing frame where each set of wires is attached to switching equipment. Electromechanical and electronic switching equipment make connections automatically. In a few remaining switchboards and in unusual situations an operator makes the connection.

Some customers make and receive more calls than a single telephone line can handle. For these calls, a system somewhat similar to a miniature central office may be installed on the customer's premises. This system is the private branch exchange (PBX), usually found in apartment and office buildings, hotels, department stores, and other business firms.

A newer type of service is called CENTREX, in which incoming calls can be dialed to any extension without an operator's assistance, and outgoing and intercom calls can be dialed by the extension users. This equipment can be located either on telephone company premises or on the customer's premises.

Other communications services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radiotelephones in automobiles, boats, airplanes and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

Telephone companies also build and maintain most of the vast network of cables and radio-relay systems for communications services, including those joining the thousands of broadcasting stations all over the Nation. These services are leased to networks and their affiliated stations. Telephone companies also lease data and private-wire services to business and government offices.

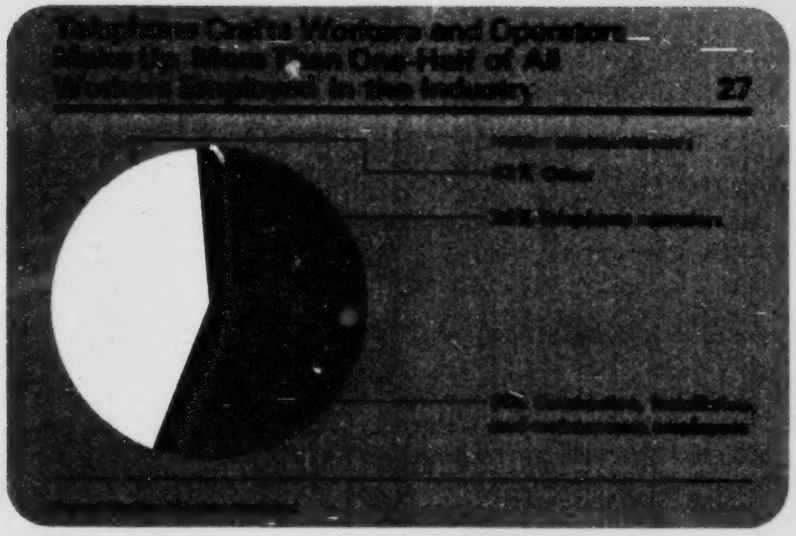
The Bell System owns about 4 out of 5 of the Nation's domestic telephones. Independent telephone companies serve the remainder. There are approximately 1,805 independent telephone companies in the United States. General Telephone and Electronics Corporation in New York City, United Utilities, Inc. in Kansas City, and Continental Telephone Corporation in St. Louis account for about 2 out of every 3 telephones serviced by independent companies.

Telephone Occupations

Although the telephone industry requires workers in many different occupations, telephone craftsmen and operators make up more than one-half of all workers. (See chart 27.)

Telephone craft workers install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform: construction workers place, splice, and maintain telephone wires and cables; installers and repairmen place, maintain, and repair telephones and private branch exchanges (PBX) in homes and offices and other places of business; and central office craft workers test, maintain, and repair equipment in central offices.

Operators make telephone connections; assist customers in specialized services, such as reverse-charge calls; and give telephone information. Detailed discussions of telephone crafts occupations and tele-



phone and PBX operators are presented elsewhere in the *Handbook*.

More than one-fifth of all telephone industry employees are clerical workers. They include stenographers, typists, bookkeepers, office machine and computer operators, keypunch operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. Clerical workers keep records of services, make up and send bills to customers, and prepare statistical and other reports.

About one-tenth of the industry's employees are professional workers. Many of these are scientific and technical personnel such as engineers and draftsmen. Engineers plan cable and microwave routes, central office and PBX equipment installations, new buildings, the expansion of existing structures, and solve other engineering problems. Many top managers and administrators have engineering backgrounds. Other professional and technical workers are accountants, personnel and labor relations workers, public relations men and publicity writers, computer systems analysts, computer programers, and lawyers.

Nearly one-tenth of the industry's employees are business and sales representatives who sell new communications services, directory advertising and handle requests for installing or discontinuing telephone service.

About 3 percent of the industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do other maintenance jobs in offices and plants. Skilled maintenance craftsmen include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telephone industry are janitors, porters, watchmen, and guards.

Employment Outlook

Telephone industry employment is expected to grow moderately through the mid-1980's. In addition to the jobs from employment growth, tens of thousands of openings will arise each year because of the need to replace experienced workers who retire, die, or leave their jobs for other reasons.

Employment will grow primarily because rising population and higher incomes will increase the need for telephone service. Greater demand for transmission of computer-processed data and other information via telephone company lines also will stimulate employment growth. Labor-saving technological innovations, however, will keep employment from growing as rapidly as telephone service.

Because of direct-dialing and other improvements in equipment, the need for telephone operators will not increase significantly. Technological innovations will restrict employment growth in some skilled crafts. For example, mechanical improvements, such as pole-lifting equipment and earth-boring tools, will limit employment of linemen. On the other hand, new technology is expected to increase the demand for engineering and technical personnel, especially electrical and electronic engineers and technicians, computer programmers, and systems analysts. Employment in administrative and sales occupations will rise as telephone business increases.

Earnings and Working Conditions

In 1972 earnings for nonsupervisory telephone employees averaged $4.24 an hour. In comparison, nonsupervisory workers in all private industries, except farming, averaged $3.65 an hour.

In early 1972, basic rates ranged from an average of $2.67 an hour for telephone operator trainees and $3.11 for experienced telephone operators, to $7.60 for professional and semi-professional workers. Clerical workers in non-supervisory positions averaged $3.62 an hour.

A telephone employee usually

starts at the minimum wage for his particular job. Advancement from the starting rate to the maximum rate generally takes 5 years.

More than two-thirds of the workers in the industry, mainly telephone operators and craftsmen, are members of labor unions. The Communications Workers of America represents the largest number of workers in the industry, but many other employees are members of the 13 independent unions which form the Alliance of Independent Telephone Unions. Others are members of the International Brotherhood of Electrical Workers.

Union contracts govern wage rates, wage increases, and the amount of time required to advance from one step to the next for most telephone workers. The contracts also call for extra pay for work beyond the normal 6 to 8 hours a day, or 5 days a week, and for all Sunday and holiday work. Most contracts provide a pay differential for night work.

Overtime work sometimes is required, especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency call-out," which is a short-notice request to report for work during nonscheduled hours, workers are guaranteed a minimum period of pay at the basic hourly rate. Travel time between jobs is counted as worktime for crafts workers under some contracts.

Paid vacations are granted according to length of service. Usually, contracts provide for a 1-week vacation beginning with 6 months of service; 2 weeks for 1 to 10 years; 3 weeks for 11 to 17 years; 4 weeks for 18 to 24 years; and 5 weeks for 25 years and over. Depending on locality, holidays range from 9 to 11 days a year. Most telephone workers are covered by paid sick plans and group insurance which usually provide sickness, accident, and death benefits, and retirement and disability pensions.

The telephone industry has one of the best safety records in American industry. The number of disabling injuries has been well below the average.

Where To Go for More Information

More details about employment opportunities may be obtained from the telephone company in your community or local offices of the unions that represent telephone workers. If no local union is listed in the telephone directory information may be obtained from the following:

Alliance of Independent Telephone Unions, P.O. Box 5462, Hamden, Conn. 16518.

Communication Workers of America, 1925 K St. NW., Washington, D.C. 20006.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

OCCUPATIONS IN THE TRUCKING INDUSTRY

In 1972, the trucking industry employed approximately 1 million workers—more than the rival rail, air, and pipeline transportation industries combined. It is a major employer of many young persons not planning to attend college, since nearly 90 percent of its freight handlers, drivers, truck maintenance personnel, or clerical workers require only a high school education.

Nature and Location of the Industry

The trucking industry is made up of firms that furnish hauling and storage services, both local and long distance, on a for-hire basis. Its terminals, located in various cities, handle distribution and pickup of freight and maintenance of trucking equipment.

Local trucking companies serve a single city and its suburbs. Others, long-distance carriers, usually travel through many States. Some firms specialize in the type of goods carried: for example, they may carry oil, grain, livestock, automobiles, or furniture that often require special equipment for truck rigging and loading and unloading.

Trucking companies operate as either contract or common carriers. Contract carriers haul commodities of one or a few shippers exclusively; common carriers serve the general public.

The industry's employment is concentrated in a relatively small number of large companies. Fewer than 10 percent of the trucking companies in interstate commerce have annual revenues of $1 million or more; however, these account for almost half of total industry employment. A large proportion of companies are small, particularly those which serve a single city. Many are owner-operated, and the owner does the driving.

Trucking industry employees work in cities and towns of all sizes, and are distributed much the same as the Nation's population.

Occupations in the Industry

About three-fourths of all trucking industry employees have blue-collar jobs, including about 600,000 truckdrivers. Other important blue-collar occupations are material handlers, mechanics, washers and lubricators, and foremen. Most white-collar employees are clerical workers, such as secretaries and rate clerks, and administrative personnel, such as terminal managers and accountants.

Men hold 9 out of every 10 jobs in the industry. Nearly all women employees are clerical workers.

The duties and training requirements of some of the important occupations are described briefly in the following sections.

Truckdriving Occupations. More than half of the industry's employees are drivers. *Long-distance truck drivers* (D.O.T. 904.883) spend nearly all their working hours driving large trucks or tractor trailers between terminals. These long-distance drivers transport goods of great value that must be delivered safely and on time. Some drivers load and unload their trucks; usually, however, other employees do this work. *Local drivers* (D.O.T. 906.883) operate trucks over short distances, usually within one city and

its suburbs. They deliver goods from trucking terminals to wholesalers, retailers, and other businesses in the area. They also pick up goods for delivery to terminals, where loads are made up for long trips.

Clerical Occupations. About 1 out of every 8 of the industry's employees is a clerical worker. Many have general clerical jobs, such as secretary or clerk-typist, which are common to all industries. Others have specialized jobs. For example, *dispatchers* (D.O.T. 919.168) coordinate the movement of trucks and freight into and out of terminals; make up loads for specific destinations; assign drivers and develop delivery schedules; handle customers' requests for pickup of freight; and provide information on deliveries. *Rate clerks* (D.O.T. 219.388) calculate shipping charges. *Claims clerks* (D.O.T. 241.368) handle claims for freight lost or damaged during transit. *Manifest clerks* (D.O.T. 222.488) prepare forms that list details of freight shipments. *Parts-order clerks* (D.O.T. 223.387) supply mechanics with replacement parts for trucks; they also take care of most of the clerical duties needed to maintain a truck repair shop.

Administrative and Related Occupations. More than 1 out of 15 employees is an administrator. Top executives manage companies and make policy decisions. Middle managers supervise the operation of individual departments, terminals, or warehouses. A small number of accountants and lawyers are employed by these companies. The industry also employs sales representatives to solicit freight business.

Material Handling Occupations. About 1 out of 12 employees moves materials into and out of trucks and warehouses. Much of this work is done by *material handlers* (D.O.T. 909.887) who work in gangs of three or four under the supervision of a dock foreman or gang leader. Material handlers load and unload freight with the aid of handtrucks, conveyors, and other devices. Heavy items are moved by *power truck operators* (D.O.T. 922.883) and *crane operators* (D.O.T. 921.280). Gang leaders determine the order in which items will be loaded, so that the cargo is balanced and items to be unloaded first are near the back of the truck. *Truckdrivers' helpers* (D.O.T. 905.887) travel with drivers to unload and pick up freight. Occasionally, helpers may do relief driving.

Truck Maintenance Occupations. About 1 out of every 20 employees takes care of the trucks. *Truck mechanics* (D.O.T. 620.281) keep trucks and trailers in good running condition. Much time is spent in preventive maintenance to assure safe operation, to check wear and damage to parts, and to reduce breakdowns. When breakdowns do occur, these workers determine the cause and make the necessary repairs. *Truck mechanic helpers* (D.O.T. 620.884) and apprentices assist experienced mechancis in inspection and repair work. *Lubrication men* and *washers* (D.O.T. 915.887 and 919.887) clean, lubricate, and refuel trucks, change tires, and do other routine maintenance.

Training, Other Qualifications, and Advancement

Workers in blue-collar occupations usually are hired at the unskilled level, as material handlers, truck drivers' helpers, or lubrication men and washers. No formal training is required for these jobs, but many employers prefer high school graduates. Applicants must be in good physical condition. New employees work under the guidance of experienced workers and foremen while learning their jobs; this usually takes no more than a few weeks. As vacancies occur, workers advance to higher rated blue-collar jobs, such as power truck operator and truckdriver. Qualifications for promotion are the ability to do the job and length of service with the firm. Material handlers who demonstrate supervisory ability can become gang leaders or dock foremen.

Qualifications for truckdriving jobs vary and depend on individual employers, the type of truck, and other factors. Every driver must have a chauffeur's license, a commercial driving permit obtained from State Motor Vehicle Departments. The U.S. Department of Transportation establishes minimum qualifications for long distance drivers. They must be at least 21 years old and able-bodied, and have good hearing and vision of at least 20/40 with or without glasses. They must also be able to read and speak English and have at least 1 year of driving experience and a good driving record. Many firms will not hire long-distance drivers under 25 years of age; they may also specify limitations on height and weight.

Young people interested in professional driving should take the driver-training courses offered by many high schools. A course in automotive mechanics is also helpful because it provides knowledge of the mechanical operations of a truck. Private truckdriving training schools offer another opportunity to prepare for a driving job. However, completion of such a course does not assure immediate employment as a driver. Graduates frequently must start as material handlers or drivers' helpers and advance to driving jobs. Prospective students should enroll

only in those truckdriving courses offered by schools which have been certified by the State.

Most truck mechanics learn their skills informally on the job as helpers to experienced mechanics. Others complete formal apprenticeship programs which generally last 4 years and include on-the-job training and related classroom instruction. Unskilled workers, such as lubrication men and washers, frequently are promoted to jobs as helpers and apprentices. However, many firms will hire inexperienced young people for helper or apprentice jobs, especially those who have completed courses in automotive mechanics.

Completion of commercial courses in high school or business school is usually adequate for entry into general clerical occupations, such as secretary or typist. Additional on-the-job training is needed for specialized clerical occupations, such as rate or claims clerk.

Generally, no specialized education is needed for dispatcher jobs. Openings are filled by truck drivers, rate clerks, or other workers who know their company's operations and are familiar with State and Federal driving regulations. Candidates may improve their qualifications by taking college or technical school courses in transportation.

Administrative and sales positions frequently are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad picture of trucking operations before they are assigned to a particular department. High school graduates may be promoted to administrative and sales positions.

Employment Outlook

Employment in the trucking industry is expected to grow rapidly through the mid-1980's. In addition to the job openings created by employment growth, many openings will arise as experienced workers retire, die, or transfer to other fields.

The general economic growth of the Nation is expected to increase the quantity of freight carried by trucks. Trucks carry virtually all freight for local distribution and a great deal of interstate freight. Also many new factories, warehouses, and stores are being located in suburbs or semirural areas where railroad transportation is not available.

Employment, however, will not increase as fast as the demand for trucking services because technological developments and a continued trend toward larger, more efficient firms will increase output per worker. As a result of these developments, rates of growth will vary among occupations. Employment of material handlers, for example, is expected to increase slowly because of more efficient freight-handling methods—such as conveyors and draglines to move freight in and out of terminals and warehouses, and cargo cages to combine less-than-truckload shipments. In contrast, employment of truckdrivers is expected to increase moderately, although improved highways and vehicles will result in bigger loads at higher speeds and fewer drivers will be required for each ton of freight.

Compared with small organizations, large companies have higher proportions of accountants, personnel workers, clerks, sales workers, truck mechanics, and foremen. Employment in most of these occupations is expected to increase very rapidly as a result of the trend toward larger trucking companies. On the other hand, terminal managers make up a greater proportion of employment in small firms, since they perform many of the tasks that are assigned to other workers in large organizations. Thus, the demand for terminal managers will grow slowly as employment becomes more concentrated in large firms.

Earnings and Working Conditions

In 1972, nonsupervisory workers in the trucking industry averaged $4.92 an hour, compared with $3.65 an hour for nonsupervisory workers in all private industries, except farming. Earnings are relatively high in the trucking industry, because drivers represent a large proportion of employment; many long-distance drivers earn more than $300 a week.

Most employees are paid an hourly rate or a weekly or monthly salary. However, truckdrivers on the longer runs generally are paid on a mileage basis for driving time. For all other work time, they are paid an hourly rate. Most employees receive premium pay for overtime, Sundays, and holidays.

Paid vacations are almost universal in the trucking industry. Typically, employees receive a 1 week vacation after 1 year of service, 2 weeks after 3 years, 3 weeks after 10 years, and 4 weeks after 15 years. Nearly all workers receive paid holidays. Most workers are covered by pension plans and life and health insurance financed at least partially by employers.

Working conditions vary greatly among occupations in the industry. Truckdriving is both physically and mentally demanding, but conditions have improved as a result of better highways, more comfortable seating, power steering, and air-conditioned cabs. Long-distance drivers frequently work at night and

spend time away from home. Local drivers usually work only during the day. Material handlers and truck-driver's helpers have strenuous jobs, although conveyor systems and other freight handling equipment have reduced some of the heavier lifting and made the work easier and safer. Truck mechanics and other maintenance personnel may have to work in awkward or cramped positions while servicing vehicles, and frequently get dirty because of the grease and oil on the trucks. In addition, most maintenance shops are hot in summer and drafty in the winter. Mechanics occasionally make repairs outdoors when a truck breaks down on the road.

Many large organizations operate around the clock and require some material handling and maintenance personnel to work evenings and nights.

A large number of trucking industry employees are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

General information about career opportunities in the trucking industry is available from:

American Trucking Association, 1616 P St. NW., Washington, D.C. 20036.

WHOLESALE AND RETAIL TRADE

Wholesaling and retailing are the final stages in the transfer of goods from producers to consumers. Wholesalers assemble goods in large lots and distribute them to retail stores, industrial firms, and institutions such as schools and hospitals. Retailers sell goods directly to housewives and other consumers in a variety of ways—in stores, by mail, or through door-to-door selling. A list of the items sold by wholesale and retail businesses would include almost every item produced by Americans—automobiles, clothing, food, furniture, and countless others.

In 1972, nearly 16 million people (not counting an estimated 2 million self-employed persons plus unpaid family workers) worked in wholesale and retail trade. Retail trade accounted for the largest number of workers—11.8 million—or about three-fourths of the employment in the industry group. The majority of these workers held jobs in department stores, food stores, and restaurants and other eating places. About 3.9 million people worked in wholesale trade.

Workers with a wide range of education, training, and skills hold jobs in wholesale and retail trade. White-collar workers account for more than 3 out of 5 workers employed in this major industry group, as shown in the accompanying table. Sales workers, the largest single group, make up nearly one-fourth of total industry employment. Managers and proprietors, the second largest group of workers, account for about one-fifth of the industry's work force. Many managers and proprietors own and operate small wholesale houses or retail businesses, such as food stores and gas stations. Clerical workers account for roughly one-sixth of the work force; many hold jobs as cashiers, especially in supermarkets and other food stores. Other important clerical occupations in retail trade include secretaries, stenographers and typists, office machine operators, and bookkeepers and accounting clerks. Large numbers of shipping and receiving clerks work in both wholesale and retail trade.

Blue-collar workers (craftsmen, operatives, and laborers) account for nearly one-fourth of the industry's job holders. Many work as mechanics and repairmen, gas station attendants, drivers and deliverymen, meat cutters, and materials handlers. Most mechanics work for motor vehicle dealers and gasoline service stations. A large number of meat cutters work in wholesale grocery establishments and in supermarkets and other food stores.

Service workers, employed mostly in retail trade, account for roughly 1 out of 7 workers in the industry group. Food service workers, such as waitresses and cooks, make up by far the largest concentration of service workers. Other large groups of service workers are janitors, charwomen and cleaners, and guards and watchmen.

Major occupational group	*Estimated employment 1972 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	2
Managers, officials, and proprietors	19
Clerical and kindred workers	17
Sales workers	23
Craftsmen, foremen, and kindred workers	7
Operatives and kindred workers	11
Service workers	15
Laborers	6

Employment in wholesale and retail trade is expected to increase moderately through the mid-1980's as sales rise in response to growth in population and income. Due to laborsaving innovations, however, employment is not expected to grow as fast as sales. The use of computers for inventory control and billing, for example, may limit the need for additional clerical workers. Improved methods of handling and storing merchandise will limit the demand for laborers.

Within retail trade, employment should rise most quickly in department stores, drugstores, restaurants, auto dealerships, and service stations. Among wholesale establishments, the rates of employment growth probably will be highest in businesses that distribute auto parts, and in firms selling industrial machinery, equipment, and supplies.

The statements that follow discuss job opportunities in restaurants and food stores. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*.

OCCUPATIONS IN THE RESTAURANT INDUSTRY

In 1972, the restaurant industry was the fourth largest industry in the country, employing 2.7 million people in establishments ranging from roadside diners to luxurious restaurants. The type of food and service a restaurant offers varies with its size and location, as well as with the kind of customer it seeks to attract. Fast-food restaurants and cafeterias in suburban shopping centers emphasize rapid service and inexpensive meals. Steak houses and pizzerias consider the quality of their specialty most important. Some restaurants cater to customers who wish to eat a leisurely meal in elegant surroundings and their menus often include unusual dishes or "specialties of the house".

Most restaurants are small and have fewer than 10 paid employees; many of these are operated by their owners, who have either no paid help or only 1 or 2 part-time workers. An increasing proportion of restaurants, however, are part of chain operations.

Restaurant jobs can be found almost everywhere. Although employment is concentrated in the States with the largest populations and particularly in large cities, even very small communities have luncheonettes and roadside diners.

Restaurant Workers

About three-fourths of all restaurant employees prepare and serve food, and keep cooking and eating areas clean. Waiters and waitresses, and cooks and chefs make up the two largest groups of workers. Also included are counter attendants, who serve food in cafeterias and fast-food restaurants; bartenders, who mix and serve drinks; busboys and busgirls, who clear tables, carry dirty dishes back to the kitchen, and sometimes set tables; kitchen workers, who wash dishes and prepare vegetables; pantrymen and pantrywomen, who prepare salads and certain other dishes; and janitors and porters, who dispose of trash, sweep and mop floors, and keep the restaurant clean. Some of these workers operate mechanical equipment such as dishwashers, floor polishers, and vegetable slicers and peelers. (Detailed information on cooks and chefs, waiters and waitresses, and bartenders is given elsewhere in the *Handbook*.)

Another large group of restaurant workers—about one-sixth of the total—are managers and proprietors. Many are owners and operators of small restaurants and, in addition to acting as managers, may cook and do other work. Some are salaried employees who manage restaurants for others.

All other restaurant workers combined account for less than one-tenth of total industry employment. Most are clerical workers—cashiers who receive payments and make change for customers; food checkers who total the cost of items selected by cafeteria customers; and bookkeepers, typists, and other office workers. A few restaurants employ dietitians to plan menus, supervise food preparation, and enforce sanitary regulations. Restaurant chains and some large restaurants employ mechanics and other maintenance workers, accountants, advertising or public relations directors, personnel workers, and musicians and other entertainers.

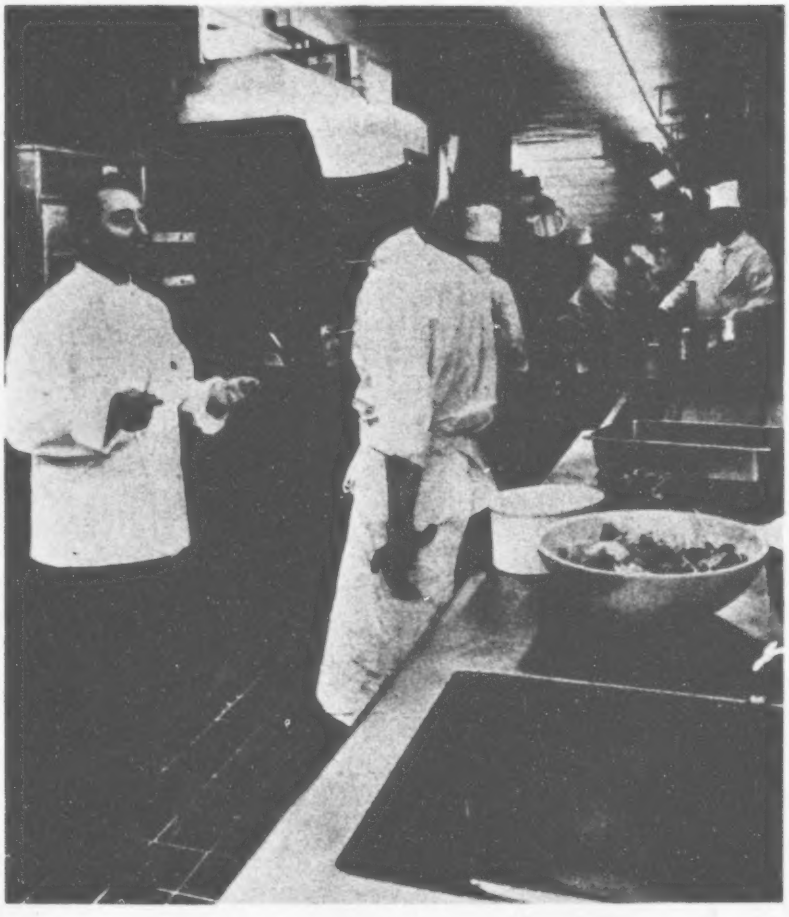
Training, Other Qualifications, and Advancement

The skills and experience needed for restaurant work vary from one occupation to another. Many jobs require no special training or experience, while others require some college or managerial experience. Requirements also vary from one restaurant to another; large or expensive restaurants usually have higher standards than diners or luncheonettes.

Young people who have less than a high school education and no previous experience often can get jobs as kitchen workers, dishwashers, or busboys. Some restaurants hire only experienced waiters and waitresses, cooks, and bartenders. Special training or many years of experience or both usually are required for chefs' positions.

Newly hired restaurant workers are generally trained on the job. Kitchen workers, for example, may be taught to operate a lettuce-shredder and make salads. Waiters and waitresses are taught to set tables, take orders from customers, and serve food in a courteous and efficient manner. In many restaurants, new employees receive their training under the close supervision of an experienced employee or the manager. Large restaurants and some chain restaurant operations may have more formal programs which often include several days of training sessions for beginners.

Many public and private high schools offer courses for persons interested in restaurant work in their vocational programs. Usually in-



Food manager and cook discuss the day's menu.

cluded are food preparation and cooking, catering, restaurant management, and other related subjects. Similar training programs are available for a variety of occupations through restaurant associations and trade unions, technical schools, junior and community colleges, and 4-year colleges. Programs range in length from a few months to 2 years or more.

Classroom and on-the-job training programs for unemployed and underemployed workers seeking restaurant jobs were in operation in a large number of cities in 1972 under the Manpower Development and Training Act (MDTA). Training under the MDTA is provided for cooks and cook apprentices, waiters and waitresses, food service supervisors, and cooks' helpers. These programs last approximately 12 to 15 weeks.

The Armed Forces also are a good source of training and experience in food service work.

A number of programs exist to train handicapped workers for restaurant jobs. Among these are projects to train mentally retarded persons for occupations, such as dishwasher and kitchen helper.

When hiring, employers look for applicants who have good health and physical stamina because restaurant workers have to work long hours, often under considerable pressure. Neatness, a pleasant manner, and an even disposition also are important, especially for waiters and waitresses and other employees who deal with the public.

Restaurants, particularly large chain operations, promote workers who have initiative and ability. Busboys or dishwashers can advance to better paying jobs such as waiter or cook's helper and then through additional training to cook, chef, baker, or bartender. Experience as maitre d'hotel may lead to a position as director of food and beverage services in a large chain organization. Assistant managers, particularly those with college training, may be promoted to manager, and eventually to a top management position.

Employment Outlook

Employment in the restaurant industry is expected to rise rapidly through the mid-1980's as restaurant business increases. In addition to the jobs from employment growth, thousands of openings will arise each year due to the need to replace experienced employees who retire, die, or stop working for other reasons.

Most openings will be for waitresses and kitchen helpers—both because of high replacement needs and because these workers make up a very large proportion of all restaurant employees. Employment opportunities also are expected to be favorable for skilled cooks and salaried restaurant managers. The number of openings in clerical jobs, such as cashier, will be relatively small. A few openings will occur in specialized positions, such as food manager and dietitian.

Population growth, rising in-

comes, and more leisure time will contribute to a growing demand for restaurant services. More people will "eat out" as the number of working wives increases and more people travel. Employment, however, will not increase as rapidly as the demand for restaurant services, because worker productivity is rising. Restaurants have become more efficient as managers have centralized the purchase of food supplies, introduced self-service, and used precut meats and modern equipment. Many restaurants now use frozen entrees in individual portions which require less time and skill to prepare than fresh foods.

Earnings and Working Conditions

Earnings of restaurant workers depend on the location, size, type, and degree of unionization of the restaurant in which they work. Also, workers in some occupations receive tips in addition to their wages.

In 1972, nonsupervisory workers in the restaurant industry averaged $2.02 an hour (excluding tips). Data from union contracts covering eating and drinking places in several large cities indicate the following range of hourly earnings for individual occupations:

	Hourly rate range
Waiters and waitresses	$1.11–$2.57
Busboys and busgirls	1.13– 2.96
Dishwashers	1.63– 3.25
Kitchen helpers	1.86– 3.59
Pantry workers	1.89– 3.74
Assistant cooks	1.89– 4.36
Porters	1.89– 3.25
Cashiers	2.00– 3.11
Checkers	2.00– 3.42
Cooks	2.46– 4.63
Bartenders	2.50– 4.63
Chefs	2.83– 5.22

Salaries of managerial workers differ widely because of differences in duties and responsibilities. Many college graduates who have specialized training in restaurant management received starting salaries ranging from $9,000 to $11,000 annually in 1972. Managerial trainees without this background often started at lower salaries. Many experienced managers earned between $12,000 and $25 000 a year.

In addition to wages, restaurant employees usually get at least one free meal a day, and often are provided with uniforms. Waiters, waitresses, and bartenders also receive tips. Paid vacations and holidays are common, and various types of health insurance programs also are available. Most full-time restaurant employees work 30 to 48 hours a week; scheduled hours may include evenings, holidays, and weekends. Many work on split shifts, which means they are on duty for several hours during one meal, take some time off, and then return to work for the next busy period.

Many restaurants are air-conditioned, have convenient work areas, and are furnished with the latest equipment and laborsaving devices. Others, particularly small restaurants, offer less desirable working conditions. In all restaurants, workers may stand much of the time, have to lift heavy trays and pots, or work near hot ovens or steam tables. Work hazards include the possibility of burns; cuts from knives and broken glass or china; and slips and falls on wet floors.

The principal union in the restaurant industry is the Hotel & Restaurant Employees and Bartenders International Union (AFL-CIO). The proportion of workers covered by union contracts varies greatly from city to city.

Sources of Additional Information

Additional information about careers in the restaurant industry may be obtained from:

National Institute for the Foodservice Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

Council on Hotel, Restaurant, and Institutional Education, 1522 K St. NW., Washington, D.C. 20005.

Information on vocational education courses for restaurant work may be obtained from the local Director of Vocational Education, the Superintendent of Schools in the local community, or the State Director of Vocational Education in the Department of Education in the State capital.

OCCUPATIONS IN RETAIL FOOD STORES

In the United States, grocery stores and supermarkets are as common as baseballs in summer, and almost always near at hand. But like the tip of an iceberg, the local food store is merely a small part of a large body known as the retail food store industry. The industry sells over 80 percent of the food eaten by Americans and employs more than 2 million workers.

Jobs vary, and workers range in education and training from high school dropouts to college-educated marketing professionals. The work is steady, and is part-time as well as full-time. Students and housewives seeking additional income often take part-time positions. Jobs in food stores are especially attractive in that the employer provides training and opportunities for advancement.

Nature of the Industry

Though food stores traditionally are classified by the type of food sold, knowing how the food is sold is important in understanding the industry. The retail food store industry pioneered in and is the most extensive user of self-service marketing techniques. As a result, there are now only two basic types of stores, supermarkets and specialty stores.

A supermarket is simply a big grocery store that sells a large variety of meat; canned, frozen, or fresh vegetables; baked goods; and other items. All supermarkets are self-service; customers select and bring items to check-out counters. Supermarkets constitute only about 20 percent of all food stores, but they employ about 60 percent of the industry's workers. Because prices are generally lower than at any other type of food store, supermarkets attract customers who buy in large quantities. When only a loaf of bread or a quart of milk is needed, however, the customer may prefer a nearby convenience or drive-up store.

Convenience stores specialize in a small variety of food and other items. They open earlier and close later than large supermarkets, and customers can make purchases quickly. Large chains own most of the 15,000 convenience stores. Though growing in number, only 5 percent of the industry's employees work in convenience stores.

Small neighborhood grocery stores are the most numerous of all food stores. Besides a small selection of popular food items, they may feature Spanish, Chinese, or other ethnic foods. Usually owners personally manage these stores and only employ additional help as needed. Few owners operate more than one store. About 20 percent of the industry's employees work in small grocery stores.

The remaining food stores operate in much the same manner as small neighborhood grocery stores. However, they feature only one type of food, such as meat, vegetables, or candy. Most are small and are usually operated by the owner and a few clerks. Approximately 15 percent of the industry's employees work in these stores.

Occupations in the Industry

About 60 percent of food store workers are clerks, cashiers, meat cutters, and meat wrappers. Managers and owner-managers account for an additional 25 percent of total employment. The remaining 15 percent are accountants, bookkeepers, truckdrivers, service workers and laborers.

Clerks in supermarkets are usually called stock or produce clerks. In the grocery department, stock clerks keep shelves filled with merchandise. As part of the job, for example, they count the cans of soup on the shelves and in the stock room before ordering more soup from the warehouse. Since storage space is limited, the order should include only as much as might be sold.

Stock clerks frequently restock items to create an attractive display. They locate specific foods for customers and perform general clean up duties. In supermarkets stock clerks may occasionally operate cash registers or bag groceries.

Produce clerks maintain the supply and desirable look of fruits and vegetables. Because fruits and vegetables are perishable, special techniques are used to keep the stock attractive. All produce is dated when it arrives at the store so that clerks know which box of fruit or vegetables to display first. Fruits and vegetables must be rotated so that the most recently delivered goods are on the bottom. Lettuce and other greens are moistened and chilled to preserve crispness. In addition, produce clerks assist in unloading delivery trucks, keep the produce department clean, answer customer questions, and weigh and bag produce.

If the store is large, clerks may assist customers in the bakery or delicatessen departments.

In the meat department, meat cut-

ters and wrappers order and prepare meats for sale. Meat is delivered to the store in large pieces. Saws and knives are used to cut it into roasts, steaks, stew meat, and ground beef. After the fat is cut away and bone chips are removed, the meat is packaged in plastic trays.

Meat wrappers use machines to wrap meat in clear plastic. The packages are then taken to a second machine to be weighed. The weighing machine prints labels identifying the type of meat, the weight, the price per pound, and the total price for each package.

At the check-out counter, cashiers ring up the price of each item on the cash register, add sales tax, make change, and bag purchases.

Cashiers, who are often the only employees customers meet, must be pleasant, courteous, fast, and accurate. Experienced cashiers memorize the prices of hundreds of items, but must detect price changes on cans and boxes. For produce and other items that change price frequently, price lists are used. When not serving customers, cashiers clean counters and restock small convenience items, such as razor blades and candy, displayed near the check-out counter.

Many supermarkets also employ workers to bag and carry groceries from the check-out counter to customers' cars. Laborers sometimes polish floors, clean windows, and do other housekeeping. The store manager observes the activities of each department, corrects problems as they arise, and is responsible for all activities and the store's success.

The central administrative offices of supermarket chains employ accountants, bookkeepers, personnel specialists, clerks, secretaries, and other office workers. Chain stores employ many truckdrivers, stock clerks, and laborers in warehouses.

Training, Other Qualifications, and Advancement

In a large supermarket, a new employee usually begins as a trainee in one of the following occupations: cashier, stock clerk, produce clerk, meat wrapper, or meat cutter. In smaller stores, however, new employees usually are trained as combination cashiers-clerks.

When hiring trainees, employers look for high school graduates who are good at arithmetic and make a neat appearance. An outgoing personality and the ability to get along with people also are important, particularly for cashiers. Applicants who have less than a high school education may be hired if they qualify in other respects.

New workers learn their jobs mostly by helping and observing experienced employees. Training time varies by occupation. A few years may be needed to qualify as a skilled meat cutter, but cashiers and produce clerks generally can learn their jobs in less than 6 months. Jobs as stock clerks and meat wrappers can be learned in even less time.

In large cities, cashier trainees, before being assigned to a store, may attend a 5-day school operated by a supermarket chain. These courses, which emphasize rapid and accurate operation of cash registers, also give instruction about customer relations, including courteous treatment of customers and handling of complaints. Trainees who pass the examination are assigned to a store to finish their training; those who fail the examination may be hired for other jobs, such as stock or produce clerk.

Some stores have meat cutter apprenticeship programs, which generally last 2 to 3 years, and include classroom instruction as well as on-the-job training.

Opportunities for promotion are fairly good for supermarket employees. Stock clerks frequently move up to better-paying jobs as produce clerks or cashiers. A produce clerk can advance to produce department manager. A meat wrapper can learn to be a cutter, and then advance to meat department manager. Cashiers and department managers can be promoted to assistant manager and, eventually, manager of a supermarket. Advancement in small food stores usually is limited, but employees may get all-round experience to start their own small businesses.

Some supermarket employees and managers advance to administrative jobs in their company's central offices. A large number of these jobs, however, are in specialized fields, such as accounting or labor relations, which require college training.

In cooperation with the National Association of Food Chains, Cornell University offers home study courses in management that are designed specifically for food industry employees who wish to improve their chances for advancement. All employees are eligible to take these courses.

Employment Outlook

Employment in the food store industry is expected to rise moderately through the mid-1980's. In addition to the jobs from employment growth each year thousands of jobs will become available as employees retire or stop working for other reasons. Many of these jobs will be part-time.

Employment in the industry is not expected to keep up with food consumption. New mechanized equipment will result in greater output per worker. For example, supermarkets may replace cash registers with computerized check-out systems. An

optical or magnetic scanner would transmit the code number of each purchase to a computer that had been programmed to record the price of the item, add the tax, and print out a receipt. The computer also would keep track of the store's inventory and place an order with the warehouse when stock is needed. This system would limit growth in the employment of cashiers and stock clerks. Nevertheless, more workers would be hired as additional supermarkets are built to keep up with the expansion of suburbs.

Earnings and Working Conditions

Earnings of nonsupervisory workers in food stores are among the highest in retail trade. In late 1972, they averaged $3.14 an hour, compared with $2.75 an hour for nonsupervisory workers in retail stores as a whole. Earnings vary considerably by occupation. Based on the limited information available, hourly rates ranged from about $1.60 for clerks with little experience to more than $6 for some highly skilled meat cutters. Earnings tend to be highest in large stores in metropolitan areas.

Most large companies provide full-time employees with a medical, hospitalization and pension plan, life insurance, and sick leave. Paid vacations and holidays also are provided.

Almost all food store employees must be able to stand for several hours at a time. Stock clerks must be capable of lifting boxes or packages weighing up to fifty pounds. Most food store occupations are not hazardous, but meat cutters must be careful when handling knives and using machinery, such as electric saws. Because they frequently work in refrigerated rooms, meat cutters also must be able to tolerate low temperatures (35° to 50°F).

Many food store employees are union members. Employees in the meat department are represented by the Amalgamated Meat Cutters Union. Other employees in the store belong to the Retail Clerks International Association.

Sources of Additional Information

Details about employment opportunities may be obtained from local food stores and the local office of the State employment service.

Specific information on the duties and qualifications of cashiers are available from:

National Association of Retail Grocers, 360 North Michigan Ave., Chicago, Ill. 606[illegible].

Information on training and other aspects of the meat cutting trade are available from:

American Meat Institute, 59 East Van Buren St., Chicago, Ill. 60605.

Amalgamated Meat Cutters and Butchers Workmen of North America, 2800 North Sheridan Road, Chicago, Ill. 60657.

FINANCE, INSURANCE, AND REAL ESTATE

Nearly every individual and organization uses services that the finance, insurance, and real estate industry provides. Financial institutions—banks, savings and loan companies, consumer credit organizations, and others—offer services ranging from checking and savings accounts to the handling of stock and bond transactions. Insurance firms provide protection against losses caused by fire, accident, sickness, and death. Real estate organizations serve as agents in the sale or rental of buildings and property, and often manage large offices and apartments.

In 1972, nearly 4 million persons worked in the finance, insurance, and real estate field. Finance, the largest sector, employed 1.7 million persons; the next largest, insurance, almost 1.4 million workers. The remainder—over 800,000—worked in real estate.

Finance, insurance, and real estate firms are a major source of job opportunities for women, who make up over half of the industry's work force. Their proportions range from about 35 percent in real estate, to over 60 percent in banking.

As shown in the accompanying tabulation, over 90 percent of the workers in the industry hold white-collar jobs. Clerical workers alone make up 46 percent of the industry's work force. Many clerical workers have jobs that are unique to particular industries, such as bank tellers in financial institutions and claim adjusters in insurance companies. Other large clerical occupations include stenographer, typist, secretary, and office machine operator—jobs also found in other industries. Sales workers constitute 21 percent of the work force. Most of these are insurance and real estate agents and brokers. A relatively small number of the sales workers sell stocks and bonds.

Managers and officials—bank officers, office managers, and others—make up 19 percent of the industry's work force. Professional and technical workers—such as accountants, computer specialists, and business research analysts—account for another 5 percent.

Major occupational group	*Estimated employment, 1972 (percent distribution)*
All occupational groups	100
Professional, technical and kindred workers	5
Managers, officials, and proprietors	19
Clerical and kindred workers	46
Sales workers	21
Craftsmen, foremen, and kindred workers	2
Operatives and kindred workers	(1)
Service workers	5
Laborers	2

[1] Less than 0.5 percent

NOTE: Due to rounding sum of individual items may not equal total.

Employment in the finance, insurance, and real estate industry is expected to increase rapidly through the mid-1980's as population grows, business activity increases, and personal incomes continue to rise. The growth of individual occupations, however, may differ from that of the industry. For example, the increasing use of data processing should continue to lessen the demand for workers in routine clerical and recordkeeping functions, while spurring the demand for workers in specialized computer occupations.

OCCUPATIONS IN THE BANKING INDUSTRY

Banks have been described as "department stores of finance" because they offer a variety of services ranging from individual checking accounts to letters of credit for financing world trade. Banks safeguard money and valuables; administer trusts and personal estates; and lend money to businesses, educational, religious, and other organizations. They also lend money for the purchase of homes, automobiles, and household items, and to cover unexpected financial needs. Banks continually strive to serve their customers' needs. In recent years, for example, they have offered revolving check credit plans, charge cards, accounting and billing services, and money management counseling.

Banks and Their Workers

Banks employed more than a million workers in 1972; about two-thirds were women. Most bank employees work in commercial banks, where a wide variety of services are offered. Others work in mutual savings banks, which offer a more limited range of services—mainly savings deposit accounts, mortgage loans, safe-deposit rentals, trust management, money orders, travelers' checks, and passbook loans. Still others work in the 12 Federal Reserve Banks (or "bankers' banks") and their 24 branches; and in foreign exchange firms, clearing house associations, check cashing agencies and other organizations doing work closely related to banking. In addition, many people are employed by savings and loan associations, personal credit institutions, and related institutions.

In 1972, commercial banks processed more than 25 billion checks, and handled an enormous amount of paperwork. Workers who do this job account for nearly two-thirds of all employees. Many are tellers or clerks who process the thousands of deposit slips, checks, and other documents which banks handle daily. Banks also employ many secretaries, stenographers, typists, telephone operators, and receptionists.

Bank officers fill the second largest occupation in the banking industry. Approximately 1 out of 5 employees is an officer—a president, vice president, treasurer, comptroller or other official. Much smaller occupations include accountants, economists, lawyers, personnel directors, marketing and public relations workers, as well as guards, elevator operators, cleaners, and other service workers.

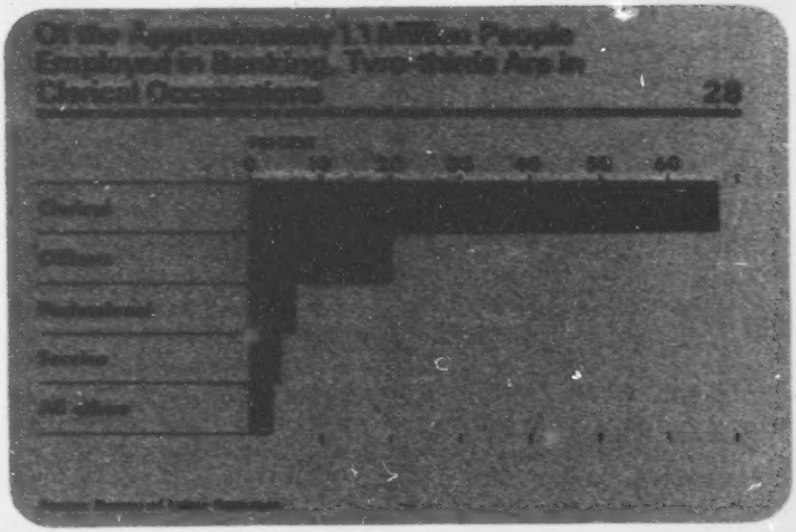
Three large occupations unique to banking—clerks, tellers, and officers—are described in separate statements elsewhere in the *Handbook*.

Places of Employment

In 1972, there were more than 37,000 commercial banks and their branches and almost 1,700 mutual savings banks and branches. Bank employment is concentrated in a relatively small number of very large banks. In 1971, for example, over one-half of all commercial bank employees worked in the Nation's 600 largest commercial banks; less than 10 percent were employed by the 7,000 smallest commercial banks.

Most bank employees work in heavily populated States, such as New York, California, Illinois, Pennsylvania, and Texas. New York

Customer contact is an important aspect of many banking occupations.



City, the financial capital of the Nation, has far more bank workers than any other city.

Training

Professional and managerial bank workers usually have completed college; most clerks have finished high school; guards and building service personnel may have less than a high school education.

Most new employees receive some form of in-service bank training. Banks also provide other opportunities for workers to broaden their knowledge and skills. Additional information about the educational requirements and training for bank clerks, tellers, and bank officers is given in the statements for these occupations elsewhere in the *Handbook*.

Many banks encourage employees to take courses at local colleges and universities. In addition, banking associations sponsor a number of educational programs, sometimes in cooperation with colleges and universities. Many banks pay all or part of the costs for those who successfully complete courses.

Bank workers also can prepare for better jobs by taking courses that the American Institute of Banking offers in many cities throughout the country. The Institute, which has 377 chapters and 200 study groups, also offers correspondence study and assists local banks in conducting cooperative training programs for various bank positions.

Bank employees should enjoy working with numbers. They also must be able to accept the responsibility of handling large amounts of money. They should present a good image to customers. Often bank officials are encouraged to participate in community activities.

Employment Outlook

Employment in banks is expected to rise rapidly through the mid-1980's. New jobs resulting from employment growth, as well as those that must be filled as employees retire, die, or stop working for other reasons, are expected to account for tens of thousands of openings each year. Still other jobs will arise as workers leave their positions to enter different types of employment.

Most openings will be for clerks. In addition, an increasing number of trainee jobs, which may lead to officer positions, will probably become available for college graduates. Many openings for professional and specialized personnel such as accountants and auditors, statisticians, and computer operators also will occur.

Bank facilities and employment will expand as population, sales, and incomes increase. Jobs also will be created as banks continue to improve and expand services such as bank charge cards and the handling of accounts for retail stores. As banks strive to bring these and other services closer to suburban areas, branch banks will grow in number and provide additional employment opportunities.

The continued conversion to electronic data processing may slow employment growth somewhat, despite the expected increase in bank services. Electronic data processing is likely to reduce the number of workers in some occupations while increasing employment in computer jobs. The effect of these developments will vary from one occupation to another, as indicated in the statements on specific banking occupations elsewhere in the *Handbook*.

Bank employees can anticipate steadier employment than can workers in many other fields, because they are less likely to be laid off during periods of low business activity. Even when a bank is sold or merged workers seldom lose their jobs. Bank officials usually reduce employment by failing to replace employees who leave their jobs.

Earnings and Working Conditions

Earnings of bank clerks, tellers, and officers are discussed in the statements for these occupations elsewhere in the *Handbook*. In addi-

tion to salaries, bank workers generally receive liberal fringe benefits. For example, most banks have some type of profit-sharing or bonus plan. In addition, group plans that provide life insurance, hospitalization, surgical benefits, and retirement income are common. Sometimes free checking accounts or safe deposit boxes also are provided.

The workweek in banks is generally 40 hours or less; in a few localities, a workweek of 35 hours is common. Tellers and some other employees work at least one evening a week when banks remain open for business. Certain check processors and operators of computing equipment may work on evening shifts.

Sources of Additional Information

Local banks and State bankers' associations can furnish specific information about job opportunities in local banking institutions. General information about banking occupations, training opportunities, and the banking industry itself is available from:

American Bankers Association, Bank Personnel Division, 1120 Connecticut Ave. NW., Washington, D.C. 20036.

National Association of Bank Women, Inc., National Office, 111 E. Wacker Dr., Chicago, Ill. 60601.

National Bankers Association, 4310 Georgia Ave. NW., Washington, D.C. 20011.

Information about career opportunities as a bank examiner can be obtained from:

Federal Deposit Insurance Corporation, Director of Personnel, 550 17th St. NW., Washington, D.C. 20429.

OCCUPATIONS IN THE INSURANCE INDUSTRY

The insurance industry offers many employment opportunities for recent high school and college graduates and experienced workers.

The 1,800 life and nearly 3,000 property/liability (also called property/casualty) insurance companies do business in home offices and in thousands of sales offices throughout the country.

Nature of the Business

There are three major types of insurance: life, property/liability, and health. Some companies specialize in one or more types; a growing number offer all kinds of insurance protection. Many life insurance companies also offer mutual fund shares and variable annuities to their customers.

Life insurance companies sell policies that provide several other kinds of protection. Under some, for example, policyholders are to receive an income when they reach retirement age or if they should become disabled; other policies may help pay the costs of educating children when they reach college age, or give extra financial protection while the children are young. Life insurance policies also are designed to protect business interests and to guarantee employee benefits. Property/liability insurance provides protection against loss or damage to policyholders' property, and protects them from financial responsibility for injuries to others or damage to their property. It covers hazards such as fire, theft, and windstorm, as well as workmen's compensation and other claims. Most life and property liability companies sell accident and health insurance, which helps policyholders pay medical expenses, and may furnish other benefits for an injury or illness.

An increasing number of insurance policies cover groups ranging from a few individuals to many thousands. These policies usually are issued to employers for the benefit of their employees. Most common are group life and health plans, although some automobile or homeowners policies are offered. In 1972, group life insurance protected almost 50 million workers; the number of policies was nearly double the number 10 years earlier.

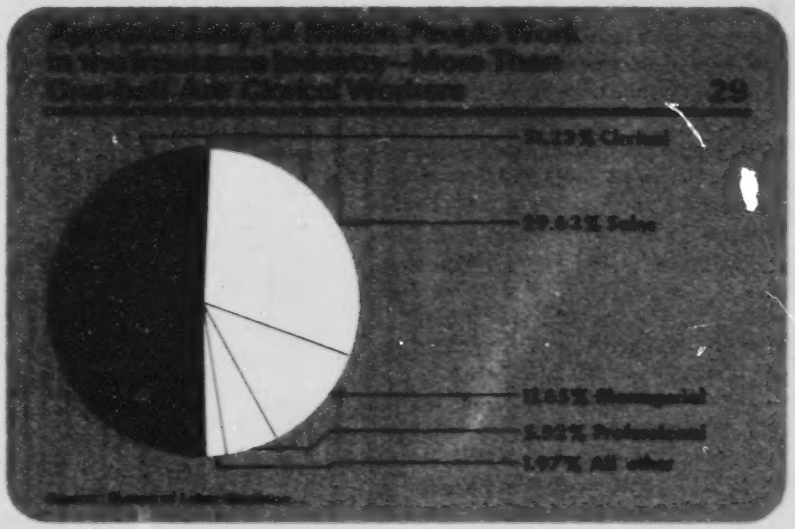
Insurance Workers

About 1.4 million people worked in the insurance business in 1972. The majority were in clerical and sales jobs. (See chart 29.)

Over half of all insurance company employees work in clerical and related jobs—a much larger proportion than in most other industries. These workers keep records of premium payments, services, and benefits paid to policyholders. Most are secretaries, stenographers, and typists; office machine operators; or general office clerks. They do work similar to their counterparts in other businesses.

Other clerical workers have positions of greater responsibility that require extensive knowledge of some phase of insurance. They include *claim adjusters* (D.O.T. 241.168) and *claim examiners* (D.O.T. 249.268) who decide whether claims are covered by the policy, see that payment is made, and, when necessary, investigate the circumstances surrounding the claim. (See the statements on Claim Adjusters and Claim Examiners elsewhere in the *Handbook*.)

About one-third of all insurance employees are sales workers— chiefly agents, brokers, and others who sell policies to individuals and business firms. *Agents and brokers*



(D.O.T. 250.258) usually find their own customers or "prospects," and see that each policy they sell provides the kind of protection required by the policyholder. (See the statement on Insurance Agents and Brokers elsewhere in the *Handbook*.)

About 1 out of 8 insurance workers has a managerial job. Managers of local sales offices often spend part of their time selling. Others, who work in home offices, are in charge of departments such as actuarial calculations, policy issuance, accounting, and investments.

Professionals, employed mainly at home offices, represent about 1 out of 24 insurance workers. These specialists, who work closely with insurance company managers, study insurance risks and coverage problems, analyze investment possibilities, prepare financial reports, and do other professional work. Among them is the *actuary* (D.O.T. 020.188) whose job is unique to the insurance field. Actuaries make statistical studies of loss experience and determine premium rates. (See the statement on Actuaries elsewhere in the *Handbook*.) Another specialist is the *underwriter* (D.O.T. 169.188), who evaluates insurance applications to determine the risk involved in issuing a policy. Underwriters decide whether to accept or reject the application; they also determine which premium rate should apply for each policy issued. (See the statement on Underwriters elsewhere in the *Handbook*.)

Other professional employees do essentially the same work in insurance companies as in other businesses. Accountants, for example, analyze insurance company records and financial problems relating to premiums, investments, payments to policyholders, and other aspects of the business. Engineers work on problems arising from industrial property/liability policies and other technical matters. Lawyers interpret the regulations that apply to insurance company operations and handle the settlement of some insurance claims. Investment analysts evaluate real estate mortgages and new issues of bonds and other securities, analyze investments held by their companies, and recommend when to hold, buy, or sell. As more computers are installed to handle office records, an increasing number of data processing specialists, including programmers and systems analysts, are being employed. Many companies also employ editorial, public relations, sales promotion, and advertising specialists.

Insurance companies require the same kinds of custodial and maintenance work as other large organizations. About 1 out of 50 workers in the insurance business performs these duties.

Additional information about many of these clerical, professional, and maintenance occupations is contained elsewhere in the *Handbook*.

Places of Employment

Many insurance employees work in California, Connecticut, Illinois, Massachusetts, New Jersey, New York, and Texas, where some of the largest insurance companies have home offices. Large numbers also are employed in agencies, brokerage firms, and other sales offices throughout the country. Almost all sales personnel work out of local offices; most professional and clerical workers, however, are employed in company home offices.

More than half of all insurance employees work in life companies and agencies; included in this group are some very large companies with thousands of employees. Property/liability companies, although more numerous than life insurance companies, generally have fewer workers. Many local agencies and sales offices also are small, regardless of the type of insurance handled.

Training, Other Qualifications, and Advancement

Insurance offers job opportunities for people having very different educational backgrounds and talents. Some positions require college training while others can be filled by workers with limited academic training and few skills.

Graduation from high school or business school is enough training for most beginning clerical jobs. Courses in typing and business math are assets; the ability to operate office machines also is helpful. These and other special skills help beginners advance to more responsible jobs.

Jobs in engineering, accounting, and other professional fields generally require the same kinds of college training here as in other businesses. College-trained people also are preferred for managerial positions, many of which are filled by promotion from within.

In all work requiring contact with the public, employees should have a pleasant disposition and an outgoing personality. Those in frequent contact with policyholders should inspire confidence in their ability to protect the customer's interests. Because insurance companies often encourage their managers and administrative employees to participate in community organizations, they should enjoy working with others in a social situation.

Insurance workers have ample opportunity to continue their education. The Insurance Institute of America, for example, has home study courses for property/liability adjusters, claim examiners, underwriters, and salesworkers. The American College of Life Underwriters, the National Association of Life Underwriters, and the Life

Underwriter Training Council offer courses that stress the services agents provide to policyholders. Other courses, especially designed to help clerical employees better understand life insurance, relate to the organization and operation of both home and field offices. These are given by the Life Office Management Association, which also provides programs for the development of supervisors and managers.

Employment Outlook

Employment of insurance workers is expected to increase moderately through the mid-1980's as the insurance industry continues to grow. In addition to new jobs that will become available, thousands of openings will occur as employees die, retire, or leave their jobs to seek other work.

The expected increase in employment will result mainly from a growing volume of insurance business. Rising personal incomes will stimulate the purchase of life insurance, including policies designed to provide retirement income or funds for future educational expenses. Property/liability insurance sales should expand as more workers buy homes, second cars, and other items that require insurance protection. More business insurance will be needed as new plants are built, new equipment is installed, and more goods are shipped throughout the country and the world. Furthermore, as the coverage of State workmen's compensation laws is broadened, more employers may need this type of insurance protection.

Growth of insurance employment, however, is not expected to keep pace with the growth of business volume for several reasons. Salesworkers are expected to become more productive as more insurance is sold through group contracts and multiple-line policies (those which cover many different risks formerly covered in separate policies). Although the total number of clerical jobs probably will continue to rise, the increasing use of computers to do routine jobs will lessen the demand for many low-skilled clerical workers. Because the computer also can write simple policies, the underwriter occupation may not grow as rapidly as in the past. In addition, State no-fault insurance plans should reduce the number of automobile claims to be adjusted, thus lessening the demand for claim adjusters.

Most insurance workers have better prospects of regular employment than workers in many other industries. Business people usually regard property/liability insurance as a necessity, both during economic recession and in boom periods; also, private individuals buy insurance to provide as much basic financial protection as possible, even when their incomes decline.

Earnings and Working Conditions

A 1972 Bureau of Labor Statistics survey of insurance companies, banks, and related businesses revealed a wide range of clerical salaries. Some clerks in beginning routine jobs earned less than $70 a week, while experienced clerical employees in more responsible positions earned up to twice that amount.

Differences in clerical salaries reflect variations in specific job duties and differences among insurance companies. Salary levels in different parts of the country also vary; earnings are generally lowest in southern cities and highest in northeastern and western metropolitan areas. (See the chapter on Office Occupations for additional information about earnings of clerical workers.)

Starting salaries for professional workers are generally comparable to those for similar positions in other businesses. According to limited information available from private surveys of life and property/liability insurance companies, 1972 college graduates started at salaries ranging from $7,300 to $10,100 a year. Specialists having several years' experience may receive annual salaries of $10,000 to $15,000. Unlike salaried professional workers, agents and brokers earn commissions on the policies they sell. (See the statement on Insurance Agents and Brokers elsewhere in the *Handbook*.) Annual salaries for supervisors in life and property/liability companies ranged from $11,500 to $20,000, depending upon the type of company operation involved.

Except for agents and brokers who sometimes must extend their working hours to meet with prospective clients, insurance company employees usually work 35 to 40 hours a week. The number of paid holidays is somewhat greater than in many other industries. Two-week paid vacations generally are granted employees after 1 year of service; in most companies, vacations are extended to 3 weeks after 5 years and, in some, to 4 weeks after 10 years. Practically all insurance company workers share in group life and health plans, as well as in retirement pensions.

Sources of Additional Information

General information on employment opportunities in the insurance business may be obtained from the personnel departments of major insurance companies or from insurance agencies in local communities.

Other information on careers in the insurance field is available from:

Institute of Life Insurance, 277 Park Ave., New York, N.Y. 10017.

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

National Association of Insurance Agents, 96 Fulton St., New York, N.Y. 10038.

American Mutual Insurance Alliance, 20 North Wacker Dr., Chicago, Ill. 60606.

For additional information on the salaries of clerical workers in finance industries, including insurance, see:

Area Wage Surveys, Metropolitan Areas, United States and Regional Summaries, (BLS Bulletin 1685-92). Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

SERVICE AND MISCELLANEOUS INDUSTRIES

An increasing share of our national wealth and manpower is being devoted to services, as a result of greater emphasis on amenities such as medical care, education, and recreation. In many ways, this trend reflects the country's goals of a better and fuller life for all its citizens.

In today's job market, the service industries are therefore an important source of employment to workers, new as well as experienced, and offer job opportunities to people with various levels of skills, training, and education.

In 1972, about 28 million people worked in service industries. About one-half were wage and salary workers employed by private firms, 11.6 million more were government employees (mainly in educational and medical services), and 2.2 million were self-employed. The remainder, accounting for 1.6 million, worked in private households.

Educational services, including elementary and secondary schools and institutions of higher education, make up the largest sector of the service industry, and account for nearly one-third of its work force. Hospitals and other establishments that provide health services constitute the next largest sector, and account for one-fifth of the workers. In both these service industries, government workers (mainly local and State) make up a large share of the work force. Other service industrices employing many workers are hotels, laundries, and other personal services, private households, business and repair services, and entertainment.

As shown in the accompanying tabulation, white-collar workers (professional, managerial, clerical, and sales workers) account for nearly three-fifths of the service industry's employment. The industry employs the highest proportion of professional, technical, and kindred workers of any major industry and these workers account for over one-third of the industry's employment. By far the largest concentration of professional personnel is represented by teachers in educational services. Other major employers of professional workers are medical and health services—where doctors, dentists, and nurses constitute a large share of the work force; and many professionals are self-employed. Clerical workers account for 1 out of 6 service industry employees. Most are stenographers, typists, secretaries, and office machine operators. Managers, officials, and proprietors, including hospital administrators, make up a relatively small fraction of the industry's employment.

Service workers represent nearly one-third of the industry's employment. The major service occupations are private household worker, practical nurse, hospital attendant, charwoman, janitor, waiter, waitress, cook, and protective service worker.

Blue-collar workers, mainly skilled craftsmen and semiskilled workers (operatives), constitute only one-eighth of the industry's employment. Many of the craftsmen work as mechanics in automobile and other repair service industries, or as maintenance workers in hotels, schools, and other establishments. Operatives work mainly in laundries, auto repair shops, and other types of repair businesses. Most of the relatively few laborers in this industry work in auto repair shops, on golf courses, and in bowling alleys.

Major occupational group	*Estimated employment, 1972 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	32
Managers, officials, and proprietors	7
Clerical and kindred workers	20
Sales workers	1
Craftsmen, foreman, and kindred workers	5
Operatives and kindred workers	4
Service workers	29
Laborers	2

Employment in the service industry is expected to increase rapidly through the mid-1980's. The sharp growth in the demand for services is expected to stem from population growth, expanding business activity, and rising personal incomes. The fastest-growing parts of the service industry will be automobile rental services, medical services, and certain firms that provide computer services and laboratory research facilities.

The need for extensive personal contact in the many service functions tends to limit the effect of technological innovations on employ-

ment requirements. Although computers may slow the employment growth in some areas—for example, in bookkeeping—technological change is not expected to limit the total demand for workers in the service industry.

The statements that follow discuss job opportunities in the hotel and laundry and drycleaning industries. More detailed information about services related to occupations that cut across many industries appears elsewhere in the *Handbook*.

HOTEL OCCUPATIONS

Hotels and motels provide travelers with a "home-away-from-home." More than 750,000 people—about half of them women—worked in hotels and motels in 1972. The majority were employed in urban areas; others worked on the outskirts of large cities, along major highways, and in resort areas.

Some hotel occupations can be entered with little or no specialized training. In many kinds of hotel work, however, the demand for persons with special skills is increasing. Hotels are complex organizations, and need specialized personnel to direct and coordinate operations which may involve thousands of guests annually and millions of dollars in property and equipment.

This statement deals with jobs in hotels, motels, and tourist courts. Separate statements on Hotel Housekeepers, Managers, Front Office Clerks, and Bellmen are found elsewhere in the *Handbook*.

The Hotel Business

Hotels are of three general types—commercial, resort, and residential. A few, residential hotels, generally accommodate people for long periods. The majority, however, are commercial hotels, which cater to travelers seeking a room for a brief stay. Some, resort hotels, provide lodging for vacationers. Motor hotels, motels, and tourist courts also cater to those seeking accommodations for a short time. Although some resort hotels, motor hotels, and motels are open only part of the year—for example, during the winter season in Florida—an increasing number are remaining open the full year.

Hotels range in size from those having only a few rooms and employees, to some having more than 1,000 rooms and many hundreds of workers. Many of the motor hotels built in recent years have large staffs. Many motels, however, including a sizable number run by the owners, have relatively small staffs.

Most hotels have restaurants that range from simple coffee shops to vast dining rooms, with wine cellars and elaborate kitchens. Large hotels and motor hotels also may have banquet rooms, exhibit halls, and spacious ballrooms. Many hotels and motels, especially in resort areas, have recreational facilities such as swimming pools, boating facilities, golf courses, and tennis courts. Hotels also may provide information about interesting places to visit, sell tickets to theaters and sporting events, and provide babysitters. Their facilities often include newsstands, gift shops, barber and beauty shops, laundry and valet services, and railroad and airline ticket reservation offices. Although motels and tourist courts usually offer fewer services than hotels, the number with restaurants, swimming pools, and other conveniences for guests is steadily increasing.

Hotel Workers

Because of the many services they offer, hotels need a variety of workers. Housekeeping is a very important part of the hotel business, and many thousands of maids, porters, housemen, linen room attendants, and laundry room workers are employed to make beds, clean rooms and halls, move furniture, hang draperies, provide guests with fresh linens and towels, operate laundry equipment, and mark and inspect laundered items. Women usually do the lighter housekeeping tasks, while men have jobs requiring more strenuous physical effort such as washing walls and arranging furniture. Large hotels and motor hotels usually employ executive housekeepers to supervise these workers; some hotels also have a manager in charge of laundry operations.

In most hotels, a uniformed staff performs guest services in the lobby. This staff includes bellmen, who carry baggage for guests and escort them to their rooms; doormen; and elevator operators.

The front office staff includes room clerks, key clerks, mail clerks, and information clerks. They greet guests, assign rooms, and furnish information. More than half of the hotel clerical workers are front office employees. The remainder, mainly women, have clerical jobs such as bookkeeper, cashier, telephone operator, and secretary. These occupations are discussed elsewhere in the *Handbook*.

Hotel managers and their assistants have the important job of supervising operations and making them profitable. A general manager directs all hotel operations. Some general managers have assistants in charge of specific operations; for example, food-service managers operate the dining rooms and other eating facilities, and sales managers are responsible for attracting more business to hotels and motels.

In addition, hotels employ many other workers who are also found in

other industries. Among these are accountants, personnel workers, entertainers, recreation workers, waiters, chefs, and bartenders. Maintenance workers, such as carpenters, electricians, stationary engineers, plumbers, and painters, also work for hotels. Still other workers employed in hotels include detectives, barbers, beauty salon operators, valets, seamstresses, and gardeners. Most of these occupations are discussed elsewhere in the *Handbook*.

Employment Outlook

Employment in this industry will expand very rapidly through the mid-1980's as population growth and increased travel spur the demand for lodging. In addition to openings that result from growth, thousands of workers will be needed each year to replace those who retire or die. Other openings will arise as workers transfer to jobs in other industries.

Most of the anticipated employment growth will stem from the need to staff new hotels, motor hotels, and motels being built in urban and resort areas. Employment is expected to rise rapidly in motels and motor hotels as Federal highway building stimulates automobile travel. Limited expansion may take place in older hotels, and those unable to modernize are likely to experience low occupancy rates that may force them to reduce costs by eliminating some services and workers. Thousands of temporary jobs will continue to be available each year in resort hotels and motels that are open only part of the year.

Most of the job openings in hotels will be for workers who need little specialized training, such as maids, porters, housemen, and some dining room employees. Large numbers also will be needed in front office jobs to replace workers who are promoted to managerial posts and to fill jobs in newly built hotels and motels. In addition, there will be openings for other clerical workers, although the increasing use of office machines may reduce clerical employment requirements in some hotels. Opportunities are expected to be favorable for people who acquire the training and experience to qualify as cooks and food managers. Technological change may limit the number of openings in a few occupations. For example, the increased use of automatic dishwashers, vegetable cutters and peelers, and other mechanical kitchen equipment is likely to reduce the need for kitchen helpers.

Earnings and Working Conditions

The location, size, and type of hotel affect earnings of hotel workers. Other significant factors are occupational tipping practices and degree of unionization. About one-half of all hotel workers are covered by the Fair Labor Standards Act, a Federal law which sets minimum wages. In 1972, hotel workers covered by the law earned at least $1.60 an hour, with tips representing as much as half of this. In addition, more than half the States have wage and hour laws that cover hotel workers.

Nonsupervisory workers in the hotel industry averaged $2.12 an hour excluding tips in 1972, about half as much as all non supervisory workers in private industry, except farming. Wages of these workers vary greatly among occupations and parts of the country. For example, workers in the Western United States usually have higher earnings than those working in the South. In addition to regular earnings, bellmen, maids, and housekeepers may receive tips. According to limited data available for some metropolitan areas, wages of bellmen averaged $1.28 an hour. Practically all bellmen surveyed received at least $20 a month in tips.

Salaries of hotel employees in managerial positions have an especially wide range, mainly because of great differences in duties and responsibilities. Hotel manager trainees who are graduates of specialized college programs start at yearly salaries ranging from $8,000 to $12,000, and are usually given periodic increases for the first year or two. Experienced managers may earn several times as much as beginners; a few, in top jobs, earn $50,000 a year or more. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

Since hotels are open round the clock, employees may work on any one of three shifts. Fewer employees work during the night than the day; they usually receive additional compensation for these shifts. Manager and housekeepers who live in the hotel usually have regular work schedules, but they may be called on at any time.

Waiters and waitresses, cooks, pantry workers, dishwashers, and other kitchen workers commonly receive meals; in a few hotels, maids, elevator operators, and room clerks also receive meals.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed personnel, such as bellmen and elevator operators, also may be members of the Building Service Employees' International Union.

Sources of Additional Information

Information on careers in hotel work may be obtained from:

The Educational Institute of the American Hotel and Motel Association, 77 Kellogg Center, Michigan State University, East Lansing, Mich. 48823.

For additional information on hotel training opportunities and a directory of schools and colleges offering courses and scholarships in the hotel field write:

Council on Hotel, Restaurant, and Institutional Education, 1522 K St. NW., Washington, D.C. 20005.

Information on housekeeping in hotels is available from:

National Executive Housekeepers Association, Inc., Business and Professional Building, Gallipolis, Ohio 45631.

OCCUPATIONS IN LAUNDRY AND DRYCLEANING PLANTS

In 1972, approximately 555,000 persons were engaged in laundering and drycleaning garments, household furnishings, and institutional linens and uniforms. These workers were located in every State, in every city, and probably in every neighborhood. About three-fifths of them were women.

Drycleaning firms accounted for more than 40 percent of the industry's workers, and laundries (including coin operated laundromats) accounted for another 35 percent. Most of the remainder worked for firms that specialized in renting and cleaning uniforms, towels, diapers, and other linens. A small proportion were employed in valet shops.

Employment is concentrated in firms that have 20 or more employees. Many firms, however, are owner-operated and have only a few employees. In 1972, about one-seventh of the industry's workers were self-employed.

Nature of the Work

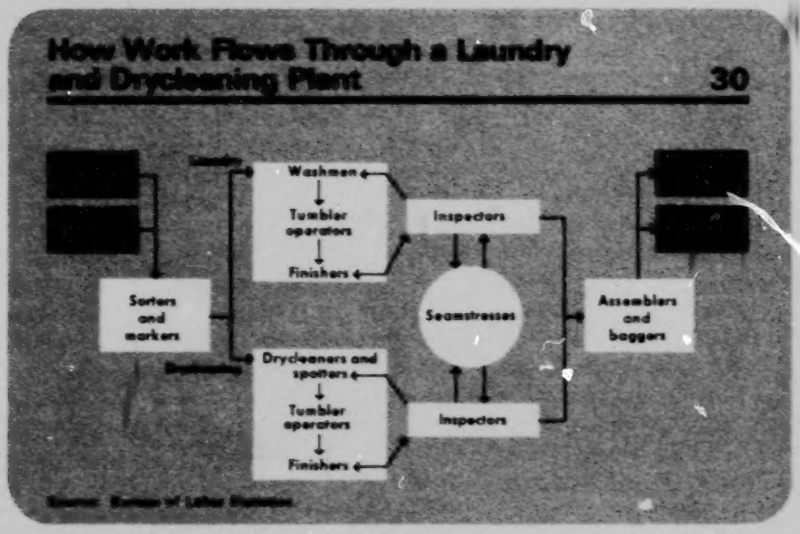
One way to describe the work done in this industry is to follow an imaginary bundle of clothes from the time it leaves the customer until the finished work is returned to him. (See chart 30.) The bundle consists of some men's shirts, a business suit, and bed linens. A *route salesman* or *driver* (D.O.T. 292.358) picks up the bundle and, after leaving a receipt, takes the bundle to the plant.

The owner of the bundle may instead leave it at the plant or drive-up store. In this case, a *counter clerk* (D.O.T. 369.887) makes out a receipt and turns the bundle over to a marker. Either the routeman or the counter clerk sorts the items in the bundle into laundry and drycleaning.

Drycleaner removes clothes from cleaning machine.

The bundle is turned over to *markers* (D.O.T. 369.887), who put an identifying symbol on each item so it may be matched with the customer's receipt at some later time. The markers then send the shirts and sheets to the washroom and the suit to the drycleaning room.

A *washman* (D.O.T. 361.885) puts several hundred pounds of sheets in a huge washing machine. He loads shirts in another washer. These machines are controlled automatically, but the washman must understand how to operate the controls—water temperature, suds level, time cycles, and the amount of agitation for different fabrics. When the washing cycle is completed, the laundry is transferred to an extractor that removes about half the water. This stage is similar to the "spin" cycle on a home washer. Conveyors move the laundry to conditioners, dryers, or tumblers where dry, heated air removes some of the remaining moisture.



The sheets go from the drying area to *flatwork finishers* (D.O.T. 363.886) who shake out folds and creases, spread the sheets on moving belts, and feed them into large flatwork ironing machines for ironing and partial folding. When the sheets come out of the machine, other finishers complete the folding and stacking.

Shirts go directly from the extractor to *shirt finishers* (D.O.T. 363.782) who usually work in teams of two or three. One finisher puts the sleeves of the shirt on a "sleever", which has two armlike forms. A second operator then puts the shirt on a "triple-head" press that irons the collar and two cuffs at the same time. The same finisher then puts the shirt on a "bosom" press that irons the front and back simultaneously. In some plants, the first finisher either folds the shirt or places it on a hanger, whichever the customer has indicated. A third finisher may do the folding. In some laundries, one shirt finisher performs all these operations.

Men's suit finisher sprays steam over jacket on hot air filled body form.

The jobs of the *drycleaner* (D.O.T. 362.782) and washman are similar, but the cleaning solution for drycleaning is a chemical solvent instead of water, and the machines generally are smaller than laundry washers. The drycleaner sorts the clothes according to color, fiber content, and fabric construction and selects the proper time cycle for each load. The drycleaner may apply special prespotting solutions to spots and stains before placing the garments in the drycleaning machine. After cleaning, a centrifuge extractor removes the solvent and then the clothes are dried in a tumbler or hot-air cabinet. The *spotter* (D.O.T. 362.381) will use chemical reagents and steam to remove stubborn stains.

A *men's suit finisher* (D.O.T. 363.782) puts the pants on special "topper" and "legger" presses. The jacket is placed on a body form that may have a second part that comes down to press and shape the shoulders and collar of the jacket while the steam is forced from the inside. Final finishing touches are done on a steam heated pressing head and "buck," a flat surface covered in fabric.

An *inspector* (D.O.T. 369.687) checks finished items to see that the quality standards of the plant have been maintained. Any item in need of recleaning or refinishing may be returned to the appropriate department; occasionally, the inspector works on them instead. Repair work may be forwarded to a *seamstress* (D.O.T. 782.884) who sews on buttons, mends tears, and resews seams. Finally, *assemblers* (D.O.T. 369.687) collect the linens and shirts by matching the sales invoice with the identification marks. Assemblers or *baggers* (D.O.T. 920.687) may remove tags before putting the items in bags or boxes for storage until called for by the customer or delivered by the routeman.

In addition to workers who are unique to laundry and drycleaning plants, many other workers are found in this industry. The manager or proprietor is responsible for seeing that the work of the plant is performed efficiently. Office workers keep records, handle correspondence, and prepare bills. Sales personnel develop new customers for the plant's services. Mechanics and repairmen keep equipment and machinery operating properly. Some service workers clean, guard, and otherwise maintain the plant; others plan and serve food to plant workers. Laborers lift and carry heavy loads to machines. (Discussion of many of these occupations can be found elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Many workers in this industry get their first jobs without previous training. Basic laundry and drycleaning skills may be learned on the job in a short time. Some jobs, such as folding towels and feeding pillowcases and sheets into a flatwork ironer, may require 1 or 2 days to learn. Some finishing jobs—pants presser, shirt finisher—may require less than a week's training. Other jobs, such as counter clerk, marker, inspector, and assembler, may require several weeks to learn. Several months or more are needed to train a drycleaner or ladies' apparel finisher. It may take 6 to 12 months to become a spotter because of the variety of fibers and fabrics, spots and stains, and chemical reagents.

Some preemployment training in finishing, drycleaning, and spotting skills is available in vocational high schools and trade schools. Similar training is available in programs administered by the U.S. Department of Labor under the Manpower Development and Training Act as well as in the Job Opportunities in the

Business Sector program carried out by the National Alliance of Businessmen. Home study courses are available from the International Fabric Care Institute.

Employers look for workers who are dependable and who have physical stamina, manual dexterity, and keen eyesight. Workers must be able to adjust to the repetitive nature of many laundry and drycleaning jobs.

Advancement for most workers in this industry is limited. Many remain permanently in the same job. Nevertheless, employers occasionally send promising employees to technical or managerial training programs or seminars on topics of general interest given by the International Fabric Care Institute at its facility in Joliet, Ill. Some men's suit finishers become skilled enough on the job to do ladies' apparel finishing. Markers and assemblers interested in finishing work usually are given an opportunity to move up to this job. Foremen and managers frequently are chosen from experienced employees already in the industry. Some drycleaners and spotters establish their own drycleaning plants.

Employment Outlook

Employment in this industry is expected to grow moderately through the mid-1980's. Besides the job openings that result from employment growth, many openings will occur as experienced workers retire, die, or transfer to other fields.

The principal reasons for increases in the demand for laundry and drycleaning services will be rising population and incomes. Also, as women increasingly seek careers outside the home, they will have less time to do laundry at home but will have the additional income to afford outside services. Offsetting some of the increased demand for laundry and cleaning services will be the easier care of the new fabrics and finishes. Many persons who have not previously done their laundry at home may consider doing so. However, drycleaning in the home probably will not be practical for many years.

These factors will result in increased employment in all occupations in the laundry and drycleaning industry except route salesmen and spotters. The number of route salesmen probably will decrease as more people take their clothes to the neighborhood plant or drive-up store for quicker, more economical service. Employment of spotters may decline over the next decade as technological innovations in fibers and finishes make fabrics less stainable.

Earnings and Working Conditions

Wage levels in the laundry and drycleaning industry are not high. In 1972, the hourly average wage for nonsupervisory workers in this industry was $2.42 compared to $3.65 for nonsupervisory workers in all industries, except farming. Earnings are higher for workers in the more highly skilled occupations such as drycleaner, spotter, and washman.

Modern laundry and drycleaning plants are clean and well lighted. Because of the heat, hot air, and steam of the cleaning processes, the plant may be uncomfortably hot during the summer months. However, large modern laundries usually have high ceilings—often three stories high—and numerous windows that may be opened for ventilation. Many new, small drycleaning plants are air-conditioned in the office and customer areas and well ventilated in the machinery areas. In addition, new machinery operates with a minimum of noise.

Sources of Additional Information

The local office of the State employment service may have additional information on training and employment opportunities in this field.

GOVERNMENT

Government service, one of the Nation's largest fields of employment, provided jobs for nearly 13.3 million civilian workers in 1972, about 1 out of 6 employed persons in the United States. State or local governments (county, city, town, village, or other local government division) employed nearly four-fifths of these workers. Nearly all of the others worked for the Federal Government in the continental United States. A small number worked for the Federal Government overseas.

Government employees represent a significant portion of each State's work force. They work in large cities, small towns and even in remote and isolated places such as lighthouses and forest ranger stations.

Employment in State and local government is expected to grow rapidly through the mid-1980's, continuing the trend begun in the late 1940's. Federal employment, on the other hand, is expected to grow slowly as administrative responsibility for some programs is transferred to the States. Many job opportunities will arise at all levels of government from the need to replace workers who retire, die, or leave the government service. Hundreds of thousands of individuals will be needed each year for jobs in a wide variety of occupations.

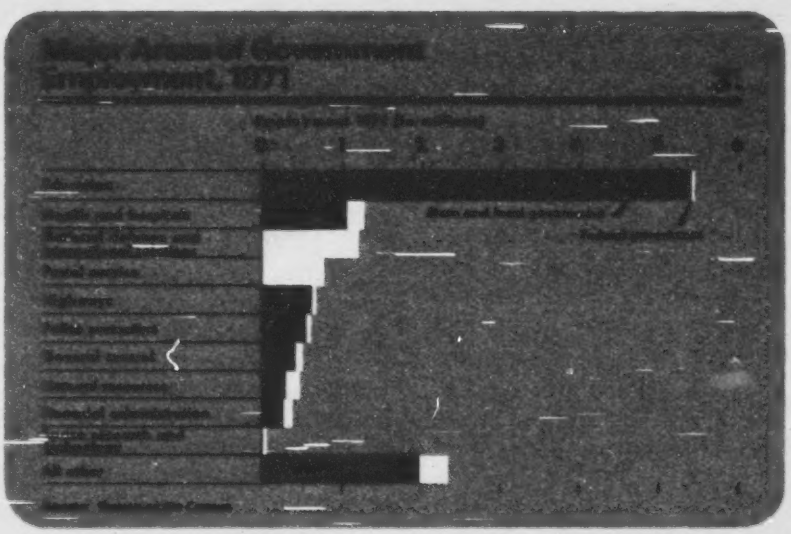
GOVERNMENT ACTIVITIES AND OCCUPATIONS

Two-fifths of all government workers in 1971, or 5.5 million, provided educational services, mostly at the State and local levels. Most worked in elementary and secondary schools. Besides teachers, others who worked in educational services included administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors.

About 1.1 million civilian government employees in 1971 worked in activities concerned with national defense and international relations, employed by The U.S. Department of Defense and State and a few smaller Federal agencies such as the Atomic Energy Commission. Occupations in this group include administrative and clerical workers, doctors, nurses, teachers, engineers, scientists, technicians, craftsmen, and other manual workers. They work in offices, research laboratories, navy yards, arsenals, and missile launching sites and in hospitals and schools run by the military services.

Another 1.3 million workers provide health services and staffed hospitals, primarily for State and local governments. Nearly 4.4 million workers were employed in housing and community development, police and fire protection, social security and public welfare services, transportation and public utilities, financial administration, general administrative functions, and judicial and legislative activities. The majority of these workers were also State and local government employees. Most of the 1.1 million government workers in postal services and natural resources, such as those in the National Park and Forest Service, were employed by the Federal Government.

Although the many different governmental activities require a diversified work force having many



different levels of education, training, and skill, two out of three government employees are white-collar workers. Among the largest white-collar occupational groups are teachers, administrators, postal clerks, and office workers such as stenographers, typists, and clerks.

Some important service, craft, and manual occupations are aircraft and automotive mechanics, repairmen, policemen, firemen, truckdrivers, skilled maintenance workers (for example, carpenters, painters, plumbers, and electricians) custodial workers, and laborers.

Because of the special character of many government activities, the occupational distribution of employment is very different from that in private industry, as shown in the accompanying table.

Table 1. Percent distribution of employment in government and private industry by occupation, 1972.

Occupation	Government[1]	Private Industry
Total	100	100
White-collar workers	67	44
Professional and technical	35	10
Managers and administrators	8	10
Clerical	23	16
Sales	(2)	8
Blue-collar workers	14	39
Craftsmen and related workers	7	15
Transport equipment operatives	3	4
Other equipment operatives	1	15
Nonfarm laborers	4	5
Service workers	19	12
Farm workers	(2)	4

[1] Excludes Federal employment overseas.
[2] Less than 0.5 percent.

NOTE: Because of rounding, sums of individual items may not equal totals.

SOURCE: Bureau of Labor Statistics.

The following chapters discuss opportunities for civilian employment in the major divisions of government and in the various branches of the Armed Forces. A separate chapter gives information on post office occupations.

FEDERAL CIVILIAN GOVERNMENT

The Federal Government is the Nation's largest employer; it employed about 2.6 million civilian workers in 1972. In addition, it employed about 60,000 U.S. citizens abroad. Federal employees work in occupations that represent nearly every kind of job in private employment, as well as some others unique to the Federal Government, such as postal clerk, border patrolman, regulatory inspector, foreign service officer, and Internal Revenue agent. Most Federal employees work for the departments and agencies that comprise the executive branch of the government. Some are employed in the legislative and judicial branches.

The executive branch includes the Executive Office of the President, the 11 cabinet departments, and more than 80 independent agencies, commissions, and boards. This branch is responsible for activities such as administering Federal laws, handling international relations, conserving natural resources, treating and rehabilitating disabled veterans, delivering the mail, conducting scientific research, maintaining the flow of supplies to the Armed Forces, and administering other programs to promote the health and welfare of the people of the United States.

The Department of Defense, which includes the Departments of the Army, Navy, and Air Force, is the largest agency. It employed about 1 million civilian workers in the United States in 1972. The departments of Agriculture; Health, Education, and Welfare; and Treasury each employed more than 100,000 workers. The largest of the independent agencies were the U.S. Postal Service, which employed about 670,000 workers and the Veterans Administration, which employed over 190,000 workers.

About 30,000 people worked for the legislative branch of government, which includes the Congress, the Government Printing Office, the General Accounting Office, and the Library of Congress. More than 8,000 people worked for the judicial branch, which includes the Supreme Court and the other U.S. courts.

The Federal Government employs about 2 million white-collar workers, including postal workers, including postal workers. Entrance requirements for white-collar jobs vary widely. Entrants into professional occupations must have highly specialized knowledge in a specified field.Occupations typical of this group are attorney, physicist, and engineer.

Entrants into administrative and managerial occupations usually are not required to have knowledge of a specialized field, but rather must indicate that they have potential for future development by graduation from a 4-year college or by responsible job experience. The entrant usually begins at a trainee level and learns the duties of the job after he is hired. Typical jobs in this group are budget analyst, claims examiner, purchasing officer, administrative assistant, and personnel officer.

Technician, clerical, and aid-assistant jobs have entry level positions that usually are filled by people who have a high school education or the equivalent. For many of these positions, no previous experience or training is required. The entry level position is usually that of trainee. Persons who have junior college or technical school training, or those who have specialized skills may enter these occupations at higher levels. Jobs typical of this group are engineering technician, supply clerk, clerk-typist, and nursing assistant.

Because of its wide range of responsibilities, the Federal Government employs white-collar workers in a great many occupational fields. About 150,000 Federal Employees work in engineering and related fields. Included in this total are about 85,000 engineers, representing virtually every branch and specialty of the profession. There also are large numbers of technician positions in areas such as engineering, electronics, surveying, and drafting. Nearly two-thirds of all engineering positions are in the Department of Defense.

Of the 115,000 workers employed in accounting and budgeting work, 34,000 are professional accountants and Internal Revenue agents. Among administrative and managerial occupations in this field are tax technician and budget administrator. There also are large numbers of clerical positions that involve specialized accounting work. Accounting workers are employed throughout the Government, particularly in the Department of Defense, the Treasury Department, and the General Accounting Office.

More than 10,000 Federal employees work in hospitals or medical, dental, public health activities. Professional occupations in this field include physician, nurse, dietitian, medical technologist, and physical therapist. Among technician and aid jobs are medical technician, medical laboratory aid, and nursing assistant. Employees in this field work primarily in the Veterans Administration; others are in the Defense

Department and Health, Education, and Welfare.

About 45,000 biological and agricultural science workers were employed. Large numbers work in forestry and soil conservation activities. Others administer farm assistance programs. Technicians and aid-assistant occupations include biology technician, forest and range fire control technician, soil conservation technician, and forestry technician. Most of these workers are employed by the Departments of Agriculture and Interior.

In the physical sciences, the Federal Government employs professional workers such as physicists, chemists, meteorologists, cartographers, and geologists. Aids and technicians in this field include physical science technician, meteorological technician, and cartographers technician. Four-fifths of the 42,000 workers in the physical sciences are employed by the Department of Defense; the National Aeronautics and Space Administration; and the Departments of Agriculture, Commerce, and Health, Education, and Welfare.

Within the mathematics field are professional mathematicians and statisticians, and mathematics technicians and statistical clerks. There also are a number of administrative positions in the related field of computer programing. Mathematics workers are employed primarily by the Defense Department, the National Aeronautics and Space Administration, and the Departments of Agriculture, Commerce, and Health, Education and Welfare. Positions in the computer field are found in most Federal agencies.

In the field of law there are more than 11,000 employees in professional positions, such as attorney, and others in administrative positions such as claims examiner. There also are many clerical positions that involve claims examining work. Workers in the legal field are employed throughout the Federal Government.

In the social science field there are professional positions for economists throughout the government; psychologists and social workers work primarily for the Veterans Administration; and foreign affairs and international relations specialists for the Department of State. Among social science administrative workers are social insurance administrators in the Department of Health, Education, and Welfare and intelligence specialist for the Department of Defense.

The Federal Government employs about 45,000 persons in investigation and inspection work. Large numbers of these workers are engaged in administrative activities, such as criminal investigation and health and regulatory inspection. Most of these jobs are in the Defense, Treasury, Justice, and Agriculture Departments.

Jobs concerned with purchasing, cataloging, storing, and distributing supplies for the Federal Government provide employment for about 67,000 workers. This field includes many managerial and administrative positions such as supply management officer, purchasing officer, and inventory management specialist, as well as large numbers of specialized clerical positions. Most of these jobs are in the Department of Defense.

Nearly 465,000 general clerical workers are employed in all departments and agencies of the Federal Government. Included in this group are office machine operators, secretaries, stenographers, clerk-typists, mail and file clerks, telephone operators, and other related workers. In addition, there are several hundred thousand postal clerks employed by the Federal Government.

Blue-collar jobs—service, craft, and manual labor—provided employment for more than 580,000 workers in 1972. Most of these workers were in establishments such as naval shipyards, arsenals, airbases, or army depots; or they worked on construction, harbor, flood-control, irrigation, or reclamation projects. The Department of Defense employed about three-fourths of these workers. Others worked for the Veterans Administration, Postal Service, General Services Administration, Department of the Interior, Tennessee Valley Authority, and Department of Agriculture.

The largest single group of blue-collar workers consists of operators and mobile equipment mechanics. These jobs include forklift operators, chauffeur, truckdriver, and automobile mechanic. The next largest group of workers are general laborers, who perform a wide variety of manual jobs.

The Federal Government employs many workers in machinery operation and repair occupations, such as boiler and steam plant operator, machinist, machinery repairman, maintenance electrician, electronics equipment repairman, and aircraft mechanic.

Skilled construction workers also are utilized widely throughout the Federal Government. Included in these fields are jobs such as carpenter, painter, plumber, steamfitter and pipefitter, and sheetmetal worker. Other important blue-collar occupations include warehouseman, food service worker and printer.

Many skilled occupations may be entered through apprenticeship programs. Experience normally is not required to qualify but a test may be given to indicate whether an applicant has an aptitude for the occupation. There also are jobs as helpers for skilled workers such as carpenter's helper and machinist's helper.

(Detailed descriptions of the work duties of most white-collar, service, craft, and manual labor jobs mentioned above are provided in other sections of the *Handbook.*)

Federal employees are stationed in all parts of the United States and its territories and in many foreign countries. Although the headquarters of most Government department and agencies are in the Washington, D.C. metropolitan area, only 1 out of 9 (about 320,000) Federal employees worked in that area in 1972. More than 300,000 worked in California, and more than 100,000 each in New York, Pennsylvania, Texas, and Illinois.

The Merit System

About 9 out of 10 jobs in the Federal Government in the United States are under the merit system. The Civil Service Act, administered by the U.S. Civil Service Commission, covers 61 percent of all Federal jobs. This act was passed by the Congress to insure that Federal employees are hired on the basis of individual merit and fitness. It provides for competitive examinations and the selection of new employees from among those who make the highest scores. The commission through its network of 65 Civil Service Commission Area Offices examines and rates applicants and supplies Federal departments and agencies with names of persons eligible for the jobs to be filled.

Some Federal jobs are exempt from Civil Service requirements, either by law or by action of the Civil Service Commission. However, most of these positions are covered by separate merit systems of other agencies such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Atomic Energy Commission, and the Tennessee Valley Authority.

Civil service competitive examinations may be taken by any U.S. citizen or person who owes permanent allegiance to the United States (in the case of residents of American Samoa). To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular job. A physical handicap will not in itself bar a person from a position if it does not interfere with his performance of the required duties. Examinations vary according to the types of positions for which they are held. Some examination test the applicant's ability to do the job applied for, or his ability to learn how to do it. Applicants for jobs that do not require a written test are rated on the basis of the experience and training described in their applications and any supporting evidence required.

Applicants are notified as to whether they have achieved eligible or ineligible ratings, and the names of eligible applicants are entered on a list in the order of their test scores. When a Federal agency requests names of eligible applicants for a job vacancy, the area office sends the agency the names at the top of the appropriate list; the agency can select any one of the top three. Names of those not selected are restored to the list for consideration for other job openings.

Appointments to civil service jobs are made without regard to an applicant's race, color, religion, national origin, politics, or sex.

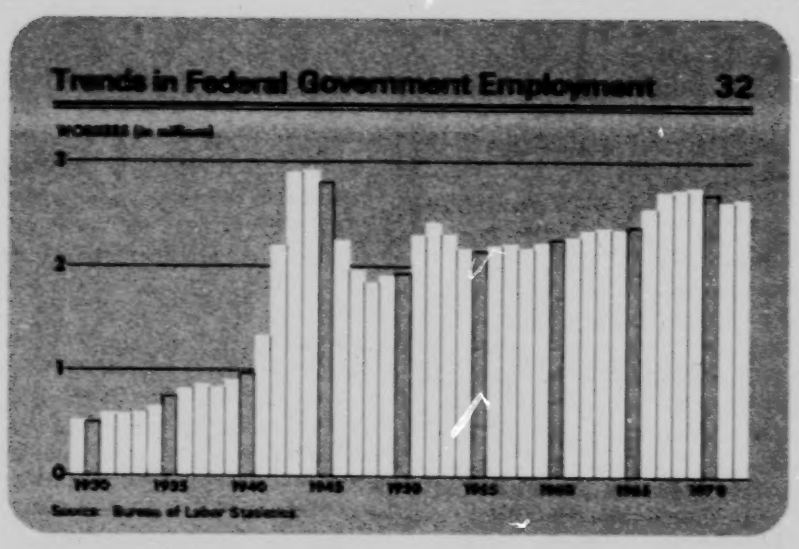
Employment Trends and Outlook

Federal employment is expected to grow slowly through the mid-1980's. In addition to new jobs created by employment growth, there will be openings due to the need to replace employees who transfer out of the Federal service, retire, or die. Thus many job opportunities will occur in occupations where total employment is relatively stable, as well as in those in which it is rising.

The proportion of Federal workers employed in professional, technical, and administrative jobs has gradually increased in recent years. On the other hand, the proportion employed in clerical and blue-collar jobs has fallen. These trends are expected to continue. The manpower requirements of the Federal Government will tend to reflect the increasing demand for services of a growing population and the country's domestic and international programs. These demands are expected to result in rising requirements for professional, administrative, and technical workers.

Population expansion will create more jobs for social security claims examiners, accounting and budget workers, and business and industry specialists. Laws that provide for new or expanded services to the public should result in increased employment of health inspectors and education personnel. Employment in legal and kindred occupations also may increase because of the existence of more laws and regulations to interpret, administer, and enforce; and more claims to examine for payment of retirement, disability, and death benefits.

Federal employment gains in science, engineering, and other fields will reflect the demands of vigorous national research and development efforts in programs such as urban development, military weapons, nuclear energy, medicine and health, transportation, and natural resource development. The employment of scientists and engineers will grow slowly, as will the employment of engineering and science technicians.



Employment in many clerical and blue-collar occupations will be limited by the Federal Government's increasing use of labor-saving electronic data-processing and materials-handling equipment and the introduction of improved data-transmission and communications systems.

Earnings, Advancement, and Working Conditions

Nearly all Federal civilian employees are paid according to one of 3 major pay systems: the General Pay Schedule, the wage system, and the Postal Field System. (The Postal Field System is discussed with Post Office Occupations elsewhere in the *Handbook*).

Nearly half of all Federal Workers are paid under the General Schedule. General Schedule (GS) pay rates are set by Congress and apply nationwide. They are reviewed annually to insure that they remain comparable with salaries in private industry. The General Schedule is a pay scale for workers in professional, administrative, technical, and clerical jobs, and for workers such as guards and messengers. General Schedule jobs are classified by the U.S. Civil Service Commission in one of 18 pay grades, according to the difficulty of duties and responsibilities, and the knowledge, experience, and skills required of the worker.

The distribution of Federal white-collar employees by General Schedule grade, the entrance and maximum salaries for each grade, and the amount of each grade's periodic increases are listed in the accompanying table. Appointments usually are made at the minimum rate of the salary range for the appropriate grade. However, appointments in hard-to-fill positions may be at a higher rate.

Employees in all grades except the highest, GS-18, receive within-grade pay increases after they have worked the required time periods, if their work is an acceptable level of competence. Within-grade increases may be given, also, in recognition of high-quality service.

High school graduates who have no related work experience usually start in GS-2 jobs, but some have special skills begin at grade GS-3. Graduates of 2-year junior colleges and technical schools often can begin at the GS-4 level. Most young people appointed to professional and administrative jobs such as psychologist, statistician, economist, writer

Table 1. Distribution of all full-time Federal employees under the General Schedule by grade level, March 31, 1972, and salary scale, effective January 7, 1973

General Schedule (GS) Grade	Employees		Salaries		
	Number	Percent	Entrance	Periodic Increase	Maximum
Total All Grades	1,281,473	100.0			
1	3,158	0.2	$ 4,798	$ 160	$ 6,238
2	25,528	2.0	5,432	181	7,061
3	101,384	7.9	6,128	204	7,964
4	168,477	13.1	6,882	229	8,943
5	163,210	12.7	7,694	257	10,007
6	82,333	6.4	8,572	286	11,146
7	111,197	8.7	9,520	317	12,373
8	26,640	2.1	10,528	351	13,687
9	139,136	10.9	11,614	387	15,097
10	19,008	1.5	12,775	426	16,609
11	146,401	11.4	13,996	466	18,190
12	127,259	9.9	16,682	556	21,686
13	96,738	7.5	19,700	657	25,613
14	44,239	3.5	23,088	770	30,018
15	22,381	1.7	26,898	897	34,971
16	3,097	.2	31,203	1,040	39,523
17	959	0.1	36,103	1,203	40,915
18	328	*	41,734		

* Less than 0.05 percent

Source: U.S. Civil Service Commission

and editor, budget analyst, accountant, and physicist, can enter at grades GS-5 or GS-7, depending on their academic record. Those who have a master's degree, or the equivalent education or experience, can enter at GS-11 level and above. Advancement to higher grades generally depends upon ability, work performance, and openings in jobs with higher grades.

About one-quarter of the federal civilian workers are paid according to the coordinated Federal Wage System. Under this system, craft, service, and manual workers are paid hourly rates which are established on the basis of "prevailing" rates paid by private employers for similar work in the same locations. As a result, the Federal Government wage rate paid for an occupation may vary among areas of the United States, as illustrated in the accompanying table.

Table 2. Coordinated Federal Wage System Hourly pay rates for Selected Occupations and location, January 1, 1973

Location	Labor (heavy)	Electrician	Tool, Die, and Gauge Maker
Atlanta, Ga.	$3.21	$5.06	$5.86
Boston, Mass.	3.65	4.65	5.20
Chicago, Ill.	3.80	5.33	5.96
Denver, Colo.	3.65	4.75	5.22
Norfolk-Portsmouth-Newport News-Hampton, Va.	3.03	4.37	4.95
Houston, Galveston-Texas City, Texas	3.42	4.92	5.57
Los Angeles, Calif.	3.84	5.21	5.79
New Orleans, La.	3.06	4.50	5.17
New York, N.Y.	3.70	4.96	5.50
Pensacola, Fla.	3.11	4.88	5.64
Philadelphia, Pa.	3.80	4.93	5.41
Seattle-Everett-Tacoma, Wash.	4.05	5.13	5.60
San Francisco, Calif.	4.10	5.51	6.11
St. Louis, Mo.	3.78	5.05	5.60
Washington, D.C.	3.46	4.91	5.60

Rates are for non-supervisory workers for the second step of a 3-step pay range.
Source: Bureau of Labor Statistics

Federal Government employees work a standard 40-hour week. Employees who are required to work overtime receive premium rates for the additional time or compensatory time off at a later date. Most employees work 8 hours a day and 5 days a week, Monday through Friday, but in some cases, the nature of the work requires a different workweek. Annual earnings for most full-time Federal workers are not affected by seasonal factors.

Federal employees earn 13 days of annual (vacation) leave each year during their first 3 years of service; 20 days each year until the end of 15 years; after 15 years, 26 days each year. Nine paid holidays are observed annually. Workers who are member of military reserve organizations also are granted up to 15 days of paid military leave a year for training purposes. A Federal worker who is laid off is entitled to unemployment compensation similar to that provided for employees in private industry.

Other benefits available to most Federal employees include: A contributory retirement system, optional participation in low-cost group life and health insurance programs partly supported by the Government, and training programs to develop maximum job proficiency and help workers achieve their highest potential. These training programs may be conducted in Government facilities or in private educational facilities at Government expense.

Sources of Additional Information

Information on employment opportunities in the Federal Government is available from a number of sources. High school students are often able to get information from their high school guidance counselors. A college placement office is often a good source of such information for college students. Information may be available, also from State employment service offices and many U.S. post offices.

Sixty-five Area Offices operated by the U.S. Civil Service Commission are located in various large cities throughout the country. These offices announce and conduct examinations required for various Federal Government jobs. They evaluate qualifications and refer eligible applicants to employing agencies for their geographic areas. They also provide a complete one-stop information service on local and nationwide job opportunities in the Federal Government service. The Area Offices also operate a toll-free telephone information service in nearly all States for those unable to visit them. Their telephone numbers are listed in most telephone books under "U.S. government."

For information about jobs in a specific agency, contact the agency directly.

OCCUPATIONS IN THE POSTAL SERVICE

Each year the U.S. Postal Service handles more than 80 billion letters and 2 billion parcels. About 700,000 workers are required to process and

deliver this mail. The vast majority of these jobs are open to workers with 4 years of high school or less. The work is steady, and the pay can range beyond $10,000 a year. Some of the jobs, such as mail carrier, offer a good deal of personal freedom. Other jobs, however, are more closely supervised and more routine.

Nature and Location of the Industry

Most people are familiar with the duties of the mailman and the post office window clerk. Yet few are aware of the many different tasks required in processing mail and of the variety of occupations in the Postal Service.

At all hours of the day and night, a steady stream of letters, packages, magazines, and papers moves through the typical large post office. Mail carriers have collected some of this mail from neighborhood mailboxes; some has been trucked in from surrounding towns or from the airport. When a truck arrives at the post office, mail handlers unload the mail, dump it onto long tables, and separate the letters, packages, and magazines into groups. Postal clerks then cancel the stamps and sort the mail according to destination.

After being sorted, outgoing mail is loaded into trucks for delivery to the airport or nearby towns. Local mail is left for carriers to deliver the next morning.

To keep buildings and equipment clean and in good working order, the Postal Service employs a variety of service and maintenance workers. Included are janitors, laborers, truck mechanics, electricians, carpenters, and painters. Some workers specialize in repairing machines that process mail.

Postal inspectors see that post offices are operated efficiently, that funds are spent properly, and that

postal laws and regulations are observed. They also prevent and detect crimes such as theft, forgery, and fraud involving use of the mail.

Postmasters and supervisors are responsible for the day-to-day operation of the post office, for hiring and promoting employees, and for setting up work schedules.

The Postal Service also contracts with private businesses to transport mail. In 1972, there were about 12,500 of these "Star" route contracts. Most "Star" route carriers use trucks to haul mail, but in some remote areas horses or boats are used instead.

In 1972, about 700,000 people, nearly 20 percent of them women, worked for the Postal Service. Almost 85 percent of all postal workers were in jobs directly related to processing and delivering mail. (See accompanying table on occupations.) This group included postal clerks, mail carriers, mail handlers, and truckdrivers. (Detailed information on mail carriers and postal clerks is given elsewhere in the *Handbook*.) Postmasters and supervisors, made up nearly 10 percent of total employment, and maintenance workers about 4 percent. The remainder included such workers as postal inspectors, guards, personnel workers, and secretaries.

The Postal Service operates more than 42,000 installations. Most are post offices, but some serve special purposes, such as handling payroll records or supplying equipment.

Although every community has at least one post office, employment is concentrated in large metropolitan areas. Post offices in cities such as New York, Chicago, and Los

Table 1. Postal Service employment by occupation, 1972

Occupation	Number	Percent
Total employment	706,400	100.0
Postal clerks	286,384	40.5
City carriers	212,561	30.1
Rural carriers	50,309	7.1
Mail handlers	43,303	6.1
Postal supervisors	38,102	5.4
Postmasters	30,731	4.4
Maintenance service workers	23,962	3.4
Motor vehicle operators	6,466	.9
Vehicle maintenance workers	5,823	.8
Postal inspectors	1,589	.2
Protection force	1,919	.3
Other	5,251	.7

NOTE: Because of rounding, the sums of individual items may not add to total.

Angeles employ a great number of workers because they not only process huge amounts of mail for their own populations but also serve as intermediate sorting points for the smaller communities that surround them.

Training, Other Qualifications, and Advancement

An applicant for a Postal Service job must pass an examination and meet minimum age requirements. Generally, the minimum age is 18, but a high school graduate may begin work at 16 if the job is not hazardous and does not require use of a motor vehicle. Many Postal Service jobs do not require formal education or special training. Applicants for these jobs are hired on the basis of their examination scores.

Applicants should apply at the post office where they wish to work and take the entrance examination for the job they want. Examinations for most jobs include a written test. A physical examination is required, as well. Applicants for jobs that require strength and stamina are sometimes given a special test. For example, mail handlers must be able to lift mail sacks weighing up to 70 pounds. The names of applicants who pass the examinations are placed on a list in the order of their scores. Separate eligibility lists are maintained for each post office. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. Disabled veterans who have a compensable, service-connected disability of 10 percent or more are placed at the top of the eligibility list. When a job opens, the appointing officer chooses one of the top three applicants. Others are left on the list so that they can be considered for future openings.

New employees usually are trained on the job by supervisors and other experienced employees. The time needed for training ranges from a few days to several months, depending on the job. For example, mail handlers and mechanics' helpers can learn their jobs in a relatively short time. Postal inspectors, on the other hand, need months of training.

Postal workers are classified as casual, part-time flexible, part-time regular, or full-time. Casual workers are hired to help handle the large amounts of mail during the Christmas season. Part-time flexible employees do not have a regular work schedule but replace absent workers or help with extra work loads as the need arises. Part-time regulars have a set work schedule—for example, four hours a day. Carriers, clerks, and mail handlers start as part-time flexible workers and move into full-time jobs according to their seniority as vacancies occur.

Advancement opportunites are available for most postal workers because there is a management commitment to provide career development. Also, employees can get preferred assignments, such as the day shift or a more desirable delivery route, as their seniority increases. When an opening occurs, employees may submit written requests, called "bids," for assignment to the vacancy. The bidder who meets the qualifications and has the most seniority gets the job.

In addition, postal workers can advance to better paying positions by learning new skills. Training programs are available for low-skilled workers who wish to become clerks or carriers. The Postal Service also has a special training center for employees who wish to become technicians or mechanics.

Applicants for supervisory jobs must pass an examination. Additional requirements for promotion may include training or education, satisfactory work record, and personal characteristics. If the leading candidates are equally qualified, length of service also is considered.

Although opportunities for promotion to supervisory positions in smaller post offices are limited, workers may apply for vacancies in a larger post office and thus increase their chances for promotion.

Employment Outlook

Employment in the postal service is expected to grow slowly through the mid-1980's to handle the increasing amounts of mail stemming from population and business growth.

Employment of mail carriers should grow slowly because mail delivery is difficult to mechanize. Employment of clerks and mail handlers is expected to grow more slowly than mail carriers because modernization of post offices and installation of new equipment will increase the amount of mail these workers can handle. Even so, turnover among clerks and mail handlers will provide many job openings.

As the Postal Service continues to improve the mail sorting process by using more sophisticated equipment, more maintenance workers will be needed to keep the machines in good working order. Although these workers make up a small percentage of total employment, opportunities should be good.

Earnings and Working Conditions

Postal Service employees are paid under several separate pay schedules depending upon the duties of the job and the knowledge, experience, or skill required. For example, there are separate schedules for production workers, such as clerks and mail

handlers; for postmasters and supervisors; for rural carriers; and for postal executives. In all pay schedules, except that of executives, employees receive periodic "step" increases up to a specified maximum, if their job performance is satisfactory. A distribution of employees in levels 1 through 8, with entrance and maximum salaries, is shown in the accompanying table.

Most mail handlers are at level 4, and postmasters and supervisors are in levels 5 through 12. Most postal clerks and mail carriers are at level 5.

Full-time employees work an 8-hour day, 5 days a week. Both full-time and part-time employees who work more than 8 hours a day or 40 hours a week receive overtime pay of one and one-half times their hourly rate.

In 1972, postal employees earned 13 days of annual leave (vacation) during each of their first 3 years of service; 20 days each year for 3 to 15 years of service; and 26 days after 15 years. In addition, they earned 13 days of paid sick leave a year, regardless of length of service.

Table 2. Employment and Salaries in the Postal Service

Grade level	Employment[1]	Salary schedules[2]	
		Entrance	Maximum
Total	455,213		
1	495	$6,178	$ 8,081
2	3,128	6,597	8,654
3	7,495	7,050	9,272
4	39,797	7,540	9,938
5	362,007	8,072	10,657
6	40,539	8,642	11,448
7	1,353	9,262	12,287
8	399	9,931	12,911

[1] On June 30, 1972; includes nonsupervisory employees in post offices who are paid annual salaries. Does not include rural carriers or part time and casual employees.
[2] In effect in mid-1972; does not include rural carriers.

Other benefits include retirement and survivorship annuities and optional participation in low-cost group life insurance and health insurance programs supported in part by the Postal Service.

Most post office buildings are clean and well lighted, but some of the older ones are not. The Postal Service is in the process of replacing and remodeling its outmoded buildings, and conditions are expected to improve.

Most postal workers are members of unions and are covered by a national agreement between the Postal Service and the unions.

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities in the Postal Service.

STATE AND LOCAL GOVERNMENTS

State and local governments provide a very large and expanding source of job opportunities in a wide variety of occupational fields. In 1972, about 10.6 million people worked for State and local government agencies; nearly three-fourths of these worked in units of local government, such as counties, municipalities, towns, and school districts.

Educational services account for the majority of jobs in State and local government. Nearly 5.6 million employees worked in public schools, colleges, or other educational services.

In addition to the nearly 3 million classroom and college teachers they employed, school systems, college, and universities also employed administrative personnel, librarians, guidance counselors, nurses, dietitians, clerks, and maintnance workers. Three-fourths of these workers were employed in elementary and secondary schools, which are administered largely by local governments. State employment in education is concentrated chiefly at the college, university, and technical school levels.

The next two largest fields of State and local government employment were health services and highway work. The 1.1 million workers employed in health and hospital work included physicians, nurses, medical laboratory technicians, and hospital attendants. More than 600,000 people worked in highway activities such as constructing and maintaining highways, streets, bridges, and tunnels.

Highway workers include civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, and construction laborers.

General governmental control and financial activities accounted for 650,000 additional workers. These included chief executives and their staffs, legislative representatives, and persons employed in the administration of justice, tax enforcement and other financial work, and general administrative work. These functions require the services of individuals such as lawyers, judges, and other court officials, city managers, property assessors, budget analysts, stenographers, and clerks.

Police and fire protection is another large field of employment. Nearly 550,000 persons were engaged in police work, primarily for local governments. Employment in police work includes administrative, clerical, and custodial personnel, as well as uniformed and plainclothes policemen. Local governments employed all the 276,000 firemen, many of whom work only part time.

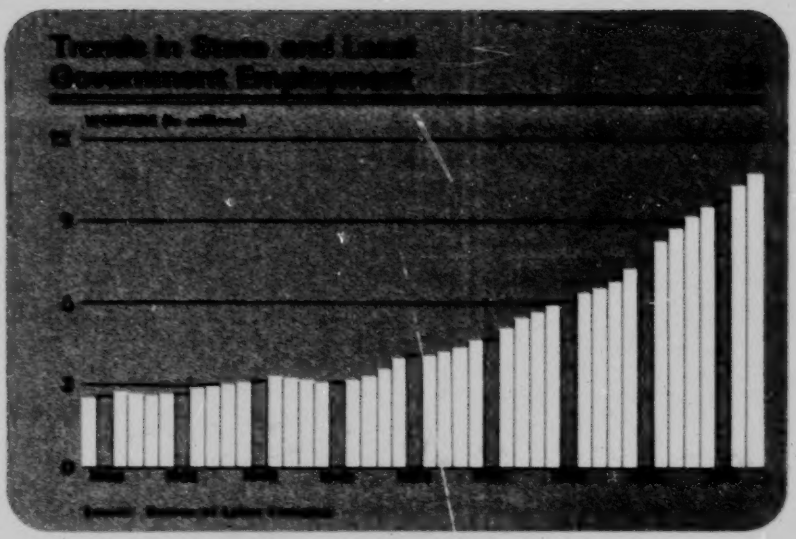
Other State and local government employees work in a wide variety of activities; local utilities (such as water, electricity, transportation, and gas supply system), natural resources, public welfare, parks and recreation, sanitation, correction, local libraries, sewage disposal, and housing and urban renewal. These activities require workers in diverse occupations such as economist, electrical engineer, electrician, pipefitter, clerk, forester, and busdriver.

Clerical, administrative, maintenance, and custodial workers make up a large portion of employment in many areas of government activity. Among the larger occupations engaged in these groups are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors. (Detailed discussions of most occupations in State and local governments are given elsewhere in the *Handbook*, in the sections covering the individual occupations.)

Employment Trends and Outlook

The long-range trend in State and local government employment has been steadily upward. (See chart 33.) Much of this growth results from the need to provide additional services as population increases and because of population movements from rural to urban areas. City development has required additional street and highway facilities; police and fire protection; and public health, sanitation, welfare, and other services. Population growth and increasing personal income have generated demand for additional and improved education, housing, hospital, and other services. Very rapid growth in State and local government employment is expected through the mid-1980's. However, employment of elementary and secondary school teachers is expected to increase more slowly than in the past, as rapid school enrollment growth shifts to higher education. This shift will create greater needs for college and university teachers and administrators.

A large State and local work force will be needed, also to provide improved public transportation systems, more urban planning and renewal programs, increased police protection, better measures to guard against air and water pollution, expanded natural resource development programs, and additional



hospital facilities. In addition, large numbers of workers will be needed to replace employees who transfer to other fields of work, retire, or die.

Federal-State programs in education, vocational training, medicine, and other fields will increase the needs of local and State governments for professional, administrative, and technical personnel. These will include engineers, scientists, social workers, counselors, teachers, doctors, and librarians.

Most positions in State and local governments are filled by residents of the State or locality. Often, however, it is necessary for State and local governments to recruit outside their areas if shortages of particular skills exist in their areas.

Earnings and Working Conditions

Earnings of State and local government employees vary widely, depending upon occupation and locality. Salaries from State to State tend to reflect differences in the general wage level in various localities. Clerical and blue-collar earnings in State and local governments generally are comparable to those of workers in similar occupations in private industry. Earnings of administrative and professional employees in many areas tend to be somewhat lower than those for similar workers in private industry.

The *Handbook* statement for individual occupations often give salary information for State and local government employment. Salary information also can be obtained from the appropriate State and local government agencies.

A majority of State and local government positions are filled through some type of formal civil service test, that is, personnel are hired and promoted on the basis of merit. In some areas, board groups of employees, such as teachers, firemen, and policemen have separate civil service coverage which applies only to their specific groups.

Most State and local government employees are covered by retirement systems or by the Federal Social Security program. They usually work a standard week of 40 hours or less, with overtime pay or compensatory time benefits for additional hours of work.

Sources of Additional Information

Persons interested in working for State or local government agencies should contact the appropriate State, county, or city agencies. Offices of local school boards, city clerks, school and college counselors or placement personnel, and local offices of State employment services have additional information.

THE ARMED FORCES

The Armed Forces offer young men and women opportunities for military careers in many occupations. Many of these are comparable to civilian occupations. Jobs range from electronic technician, mechanic, or construction equipment operator to specialties such as interpreter, nurse, or employment counselor. People who enlist usually are taught the skills needed to perform jobs such as these.

Nearly 2.4 million people, 45,000 of them women, served in the Armed Forces in 1972: 726,000 in the Air Force, 811,000 in the Army, 588,000 in the Navy, 198,000 in the Marine Corps, and 38,000 in the Coast Guard. The Armed Forces are maintained through voluntary enlistments supplemented when needed by a Selective Service System which can draft young men between the ages of 18 1/2 and 26. When drafted they serve for 2 years on active duty followed by 4 years in the reserves.

The Armed Forces are now staffed solely through enlistments. A young person may enlist in any one of a variety of programs that involve different combinations of active and reserve duty. One option allows enlistment in the reserves for 6 years, at least 4 months of which are to be spent on active duty. Young people also may choose to serve their entire enlistment on active duty for 3 or 4 years. If qualified, they may enter one of several officer training programs and serve as commissioned officers. They may join the Reserve Officers' Training Corps (ROTC) in college and receive some military training as part of their college instruction. While in college, they are paid $100 a month and agree to serve on active duty as a commissioned officer for at least 2 years after they graduate. In addition, about 19,000 ROTC scholarships are awarded each year, which cover the costs of tuition and books and provide $100 a month for subsistence. These enlistment choices and the draft are subject to change by congressional action at any time.

Most enlisted jobs in the Armed Forces require special classroom training; on-the-job training is given for the remainder. People who enlist are often able to choose the type of training they receive, those who reenlist are often offered advanced training. It is possible for a young person to be trained in electronics, aircraft maintenance, metalworking, or other skilled work. In many instances, the vocational training and experience they receive in the Armed Forces are helpful in obtaining civilian jobs.

In addition to on-duty training, a variety of voluntary off-duty academic and technical training programs are available to military personnel. The U.S. Armed Forces Institute (USAFI) offers about 235 correspondence courses ranging from the elementary school level to the second year of college. The USAFI also offers about 6,000 courses which are given under contract by colleges and universities. In the Resident Center Program, civilian institutions offer courses leading to high school diplomas and college degrees; the Prep Program also helps service men and women to get high school diplomas. The Serviceman's Opportunity College enables servicemen to get a junior college or vocational education. Courses in these programs may be taken at military installations or, if available, at local civilian institutions. The Military Extension Correspondence Course Program also offers technical courses in military specialties that are designed to advance career capabilities.

The Armed Forces also offer training to many servicemen during their final 6 months of service to prepare them for civilian jobs. This Transition Program provides counseling, training, education, and placement services to the combat-disabled, those who have no civilian work experience or skills, and those who may need to earn high school equivalency diplomas.

Earnings in 1973 for ranks or pay grades which persons might achieve during their first enlistment in the Armed Forces as commissioned officers or enlisted members are shown in the accompanying table.

Table 1. Regular Military Compensation in 1973 for Members of the Armed Forces Who are Single and Have Less than 2 Years of Service

Pay grade	Regular military compensation, total	Basic pay	Quarters allowance	Subsistence allowance	Tax advantage
Enlisted members:					
E-1	$5,310	$3,687	$720	$602	$301
E-2	5,798	4,108	767	602	321
E-3	6,085	4,270	868	602	345
E-4	6,400	4,439	979	602	380
Commissioned officers:					
O-1	9,194	6,793	1,306	575	520
O-2	10,671	7,826	1,663	575	607
O-3	12,108	8,978	1,902	575	653

SOURCE: Department of Defense.

Almost all who enlist are promoted to pay grade E-3 within their first 6 months of service. Further advancement to higher pay grades depends upon individual merit, but pay increases within a grade are possible on the basis of length of service. Enlisted members are usually furnished quarters and meals but those who live off base receive allowances for quarters and subsistence. These allowances are not taxed, providing an advantage over civilian workers who must earn a higher gross income to have the same take-home pay. Servicemen with dependents are paid proportionately higher allowances.

Many members of the Armed Forces also earn additional "Special Pay." Doctors, dentists, optometrists, and veterinarians earn from $1,200 to $4,200 extra each year depending on their length of service. People who perform work considered hazardous, such as those on flight crews or submarines, receive "Incentive Pay" ranging from $600 to $1,260 annually if they are enlisted members, and from $1,200 to $2,940 if they are officers. Many enlisted members of the Armed Forces also receive extra pay ranging from $600 to $1,800, because they have skills which are in short supply. Enlisted men and women who choose to enlist for another tour of active duty receive a bonus of from $2,000 to $10,000, depending on the skills they possess.

Members of the Armed Forces enjoy many fringe benefits. They receive free medical and dental care and 30 days of paid leave annually. They pay reduced prices for travel and for entertainment and purchases on military installations. They have access to athletic and recreation facilities. The military retirement system also provides many benefits and services to persons who are disabled in the line of duty or who retire after at least 20 years of service.

Each of the military services publisnes handbooks and pamphlets that describe entrance requirements, training and advancement opportunities, and other aspects of military careers. These publications are available at all recruiting stations, most State employment service offices, high schools, colleges, and public libraries.

TECHNICAL APPENDIX

This appendix is designed for readers who wish to know more about procedures followed in developing employment outlook than is presented in preceding reports.

Employment Outlook Conclusions

The employment outlook in the occupational reports is based on extensive economic and statistical analyses and information from many sources. Although sources and analyses among occupations and industries differed, the same general pattern was followed. To insure consistency of individual occupations and industries, the economy, based on an assumption of relatively full employment, was analyzed. Projections were made of the population, labor force, gross national product, average weekly hours, employment in major industries, and related economic measures and the individual reports were tied to these projections.

Many studies were based heavily on an analysis of past and prospective population trends, including expected changes in school and college enrollment, employment of women, and urban and suburban population. Population influences employment requirements in fields such as teaching and health and is of great importance in many industries—for example, residential construction, baking, telephone communication, and retail trade.

Many factors besides population size and composition affect employment in business and industry. Consumer purchasing patterns change as income levels shift and new products are developed. Technology brings changes in raw materials and equipment needed in production and influences the size, occupation, and skill of the work force. Research and development and government policies, such as defense and space programs, also bring about changes in occupations.

Each industry was analyzed and demands for its products or services were projected. These projections then were translated into estimates of numbers and kinds of workers needed to produce services and products. Taken into account were employment trends of total employment, different occupations, productivity trends, and possible further reductions in the workweek.

Population and labor force trends are from the decennial Censuses of Population and the monthly labor force surveys conducted by the Bureau of the Census for the Bureau of Labor Statistics. Data also were drawn from the Censuses of Manufactures and Business conducted by the Census Bureau.

Information also was utilized from a variety of sources. Among the major sources were licensing agencies, labor unions, professional and trade associations, and special surveys.

Statistics on employment in nonagricultural establishments provided monthly data on employment, hours of work, earnings, and labor turnover, based on reports for the past quarter-century or more* from a sample of industrial, commercial, and governmental establishments.

*See *Employment and Earnings*, U.S. Department of Labor, Bureau of Labor Statistics.

Also contributing to the analysis of future trends was the Bureau's series of studies of productivity and technological development, information obtained in cooperation with the National Science Foundation about employment of scientists and engineers in research and other activities, and the Occupational Industry Matrix. The matrix consists of a set of tables for 115 industries, each showing a percentage distribution of employment among 160 of the most important occupations. The matrix was valuable in appraising the effects of changing employment levels in different industries, in specific occupations, and in each occupation.

Conclusions based on an analysis of these various sources generally show increased employment, but these expected gains do not indicate the number of job openings. In most occupations, more workers are needed yearly to replace those who retire, die, or leave the occupation than are needed for growth. Consequently, even declining occupations may offer employment opportunities to many young people. To estimate the number of possible openings in an occupation, the Bureau has developed tables, similar to the actuarial tables of life insurance companies, to assess future rates of replacement from deaths and retirement. In occupations in which men are predominant, the rate of replacement for death and retirement is generally lower than that for women because so many women leave paid employment for marriage

or family responsibilities. The automobile mechanics rate, for example, is about 1.5 percent each year, while that for stenographers, in which women predominate, is 6.8.

Information so far in this section relates to the demand for workers. To appraise prospective employment opportunities in an occupation, information on probable future supply of personnel is important. Statistics on high school and college enrollments and graduation, compiled by the U.S. Office of Education, are the chief sources of information on the potential supply of personnel in professions and other occupations requiring extensive formal education. Data on numbers of apprentices from the U.S. Department of Labor's Bureau of Apprenticeship and Training provide some information on new entrants into skilled trades.

Many of the sources and approaches referred to earlier have been developed in recent years. Economic forecasting is still in the developmental stage and at best is difficult and uncertain. Basic assumptions and underlying projections (enumerated in the section on Tomorrow's Jobs in the front of the *Handbook*) should be kept in mind. Within the framework of assumptions, basic employment trends can be discerned with sufficient accuracy to meet the needs of young people preparing for careers.

Index to Occupations and Industries

Able seamen, *see:*
Merchant marine industry 743
Merchant seamen 301
Accelerator operators, atomic energy 655
Account executives, advertising 130
Account executives, *see:* Securities salesworkers 239
Accountants 128
See also: Insurance industry 776
Accounting clerks, *see:*
Bank clerks 115
Bookkeeping workers 87
Acidizers, petroleum and natural gas 637
Acquisition librarians 213
Actors and actresses 576
Actuaries 119
See also: Insurance industry 776
Actuary clerks, *see:* Statistical clerks 100
Adding machine operators 93
Adjuster, claim, insurance 121
Administrative and related occupations 128
Administrators, hospital 519
Administrators, medical record 521
Admissions counselors, *see:* College student personnel workers 135
Adult services librarians 213
Advertising artists and layout men 131
Advertising copywriters 131
Advertising managers 130
Advertising production managers 131
Advertising workers 130
Advisors, student 135
Aeronautical engineers, *see:* Aerospace engineers 342
Aeronautical technicians 392
Aerospace engineers 342
Agency cashiers 89
Agents, *see:*
Insurance agents and brokers 226
Real estate salesworkers and brokers 233
Agricultural economists 624
Agricultural engineers 343
See also: Agriculture 624
Agricultural quarantine inspectors 190
Agriculture 619
Agriculture, occupations related to 624
Agriculture teachers, vocational 625
Agronomists 365
See also: Agriculture 624
Air-conditioning and refrigeration mechanic .. 411
See also:
Electronics manufacturing 681
Office machine and computer manufacturing 713
Air-conditioning, heating, and refrigeration technicians 392
Air-conditioning, refrigeration, and heating mechanics 411
Air traffic controllers 286
Air transportation occupations 286
Aircraft mechanics 287
Aircraft, missile, and spacecraft manufacturing, occupations in 643
Airline dispatchers 289
Airline traffic agents and clerks 297
Airplane mechanics, aircraft mechanics 287
Airplane pilots 294
Airport traffic controllers 286
Alcohol, tobacco, and firearms inspectors 192
Aluminum industry 676
Ampoule examiners, drug industry 676
Ampoule fillers, drug industry 676
Analysts, systems 111
Anatomists 366
Animal husbandry specialists, life scientists ... 624
Animal physiologists and animal husbandmen, *see:* Agriculture 624
Anncalers, *see:*
Aluminum industry 651
Foundries 685
Announcers, radio and television 611
Anode men, aluminum industry 649
Anodizers, electronics manufacturing 681

Anthropologists 652
Apparel industry, occupations in the 654
Appliance servicemen 413
Arc cutters, *see:* Welders 81
Archeologists, *see:* Anthropologists 529
Architects 586
Architects, landscape 599
Archivists, *see:* Historians 534
Armament assemblers, aircraft, missiles, and spacecraft 646
Armed Forces 799
Art directors, *see:* Commercial artists 589
Art, design, and communications related occupations 575
Artists, *see:*
Advertising workers 131
Commercial artists 589
Artists and letterers, printing and publishing .. 726
Asbestos and insulating workers 248
Assemblers 50
See also:
Apparel industry 656
Electronics manufacturing 680
Laundry and dry cleaning plants 785
Motor vehicle and equipment manufacturing 707
Assemblers, bench 50
Assemblers, floor 50
Assembly inspectors, aircraft, missiles, and spacecraft 646
Assignment clerks, *see:* Statistical clerks 100
Associate directors, radio and television 748
Astronautical engineers, *see:* Aerospace engineers 377
Astronomers 342
Astrophysicists, *see:* Astronomers 377
Atomic energy field, occupations in the 660
Attendants, gasoline service station 224
Attendants, parking 324
Attorneys 141
Audio-control technicians, broadcast technicians 387
Audiologists 514
Auger operators, coal mining 631
Automatic pinsetting machine mechanics 422
Automatic transmission specialists, *see:* Automobile mechanics 417
Automobile air-conditioning specialist, *see:* Automobile mechanics 417
Automobile body repairmen 415
Automobile-glass mechanics, *see:* Automobile mechanics 418
Automobile manufacturing occupations, *see:*
Motor vehicle and equipment manufacturing 704
Automobile mechanics 417
Automobile painters 51
Automobile parts countermen 219
Automobile-radiator mechanics, *see:* Automobile mechanics 418
Automobile salesworkers 220
Automobile service advisors 222
Automobile trimmers and installation men 53
Automobile upholsterers 53
Auxiliary equipment operators, electric power . 736
Auxiliary nursing workers, *see:* Nursing aides . 505
Aviation maintenance inspectors 191
Aviation operations inspectors 191
Aviation safety officers 191

Babysitters, *see:* Private household workers ... 176
Backtenders, paper and allied products 717
Bacteriologists, *see:* Drug industry 675
Baggers, laundry and dry cleaning 685
Bakers, all-round 670
Bakery routemen 237
Baking industry 669
Ballet dancers 578
Bank clerks 114
Bank officers 116
Bank tellers 117
Banking industry 772
Banking occupations 114
Bankmen, printing and publishing 726
Bar boys, *see:* Bartenders 161
Barbers 169
Barker operators, paper and allied products ... 716
Barkermen, lumber mills 701
Bartender helpers 161
Bartenders 161
Beater engineers, paper and allied products ... 717
Beauticians 171
Beauty operators 171
Bell captains 170
Bellboys 170
Bellmen and bell captains 170
Bench assemblers 50
Bench coremakers, foundry 29
Bench hands, baking 669
Bench molders, foundry occupations 28
Benchmen, optical mechanics 431
Bill clerks, *see:* Merchant marine industry 744
Billing machine operators 92
Biochemists 363
See also: Life scientists 366
Biological aides, *see:*
Engineering and science technicians 391

Food processing technicians 396
Biological scientists 675
Biological oceanographers, *see:*
Life scientists 366
Oceanographers 360
Biological technicians 391
Biologists, *see:*
Drug industry 675
Life scientists 365
Biomedical engineers 343
Blacksmiths 55
See also: Railroad shop trades 310
Blocksetters, lumber mills 701
Blowers, iron and steel 693
Boat motor mechanics 420
Boatswains, *see:*
Merchant marine industry 743
Merchant seamen 302
Body repairmen, automobile 415
Boiler operators, electric power 736
Boilermakers 57
See also:
Industrial chemicals 688
Iron and steel industry 696
Railroad shop trades 310
Boilmaking occupations 56
Bookbinders and related workers 40
Bookkeepers 87
See also: Bank clerks 114
Bookkeeping machine operators, *see:*
Bank clerks 114
Office machine operators 92
Bookkeeping workers 87
Bookmobile librarians 213
Bosuns, *see:* Merchant seamen 302
Botanists 365
See also:
Drug industry 676
Life scientists 365
Bowling-pin-machine mechanics 422
Box office cashiers 88
Brake mechanics, *see:* Automobile mechanics . 417
Brakemen, railroad 305
Brattice men, *see:* Coal mining 631
Bricklayers 250
See also:
Aluminum industry 652
Iron and steel industry 696
Bricklayers' tenders 256
Brickmasons 250
Bridge and building workers, railroad 306
Broadcast technicians, radio and television 387
Brokers, insurance 226
Brokers, real estate 232
Buckers, logging 701
Building custodians 155
Building inspectors 196
Building laborers 256
Building trades 245
Bull-chain operators, lumber mills 701
Bundlers, apparel 655
Bus boys and girls, waiters and waitresses 167
Bus mechanics 434
Busdrivers, intercity 315
Busdrivers, local transit 317
Bushelmen, apparel 656
Business machine operators 92
Business machine servicemen 423
Butlers, *see:* Private household workers 176

Cabdrivers 325
Cable splicers, *see:*
Electric power industry 740
Telephone industry 407
Calculating machine operators 93
Cameramen, printing, *see:*
Lithographers 726
Printing and publishing 726
Captain, *see:*
Merchant marine industry 743
Merchant marine officers 298
Pilots and copilots 294
Car checkers, statistical clerks 99
Card-to-tape converter operators, *see:* Electronics computer operating personnel 107
Career planning counselors, college, *see:*
College career planning and placement counselors 550
College student personnel workers 135
Caretakers, *see:* Private household workers ... 176
Carmen, railroad shop 310
Carpenters 252
See also: Coal mining 631
Carpet craftsmen, *see:* Floor covering installers 262
Carriers, mail 199
Cartographers, *see:* Geographers 536
Casework aides, *see:* Social service aides 568
Caseworkers, social 571
Cashiers 88
Cashiers, retail food stores 768
Cashier checkers 89
Casting inspectors, foundries 685
Casting operators, *see:* Aluminum industry ... 650
Catalogers, *see:* Librarians 213
Catholic priests 556
Cement finishers 254

Cement masons 254
Cementers, petroleum and natural gas 637
Central office craftsmen, telephone 405
Central office repairmen, telephone 405
Ceramic engineers 344
Certified public accountants 128
Chainmen, *see:* Surveyors 399
Check encoders, *see:* Bank clerks 115
Check inscribers, *see:* Bank clerks 115
Check-out clerks, *see:* Cashiers 89
Checkers, apparel industry 656
Checkers, *see:*
Baking industry 670
Cashiers 89
Checkers, *see:* Draftsmen 390
Checkers, motor vehicle and equipment manufacturing 707
Chefs, *see:* Cooks and chefs 163
Chemical analysts, *see:* Aluminum industry ... 652
Chemical engineers 345
See also:
Aluminum industry 652
Drug industry 676
Industrial chemical industry 687
Paper and allied products industry ... 719
Petroleum refining 723
Chemical mixers, *see:* Photographic laboratory occupations 71
Chemical oceanographers 360
Chemical operators 688
Chemical technicians 392
Chemists 379
See also:
Atomic energy field 665
Drug industry 675
Electronics manufacturing 679
Industrial chemical industry 687
Iron and steel industry 697
Office machine and computer manufacturing 712
Paper and allied products 718
Petroleum refining 723
Chief cooks, *see:*
Merchant marine industry 744
Merchant marine seamen 302
Chief drillers, petroleum and natural gas 636
Chief engineers, *see:* Merchant marine officers . 298
Chief engineers, radio and television 749
Chief mates, *see:* Merchant marine officers ... 298
Chief stewards, *see:*
Merchant marine industry 744
Merchant marine seamen 302
Child welfare workers, *see:* Social workers .. 571
Children's librarians 213
Chippers, foundries 685
Chippermen, paper and allied products 716
Chiropractors 473
Chockermen, logging 701
Choreographers, *see:* Dancers 579
Christmas Club tellers, *see:* Bank tellers 117
Cindermen, iron and steel 694
City managers 132
Civil aviation occupations 731
Civil engineering technicians 392
Civil engineers 345
See also: Iron and steel industry 697
Civil service workers, Federal Government 691
Civilian government, Federal 789
Claim adjusters, *see:*
Insurance industry 775
Insurance occupations 121
Claim examiners, insurance 123
See also: Insurance industry 775
Claim representatives, insurance 124
Claim reviewers, insurance 124
Claim workers, insurance 124
Claims clerks, *see:* Trucking industry 759
Classification clerks, statistical clerks 99
Cleaners, *see:* Building custodians 155
Cleaning and related occupations 155
Clergymen 553
Clerical occupations 86
Clerk-typists 105
Clerks, *see:*
Account clerks, bank clerks 114
Accounting clerks, bookkeeping workers . 87
Actuary clerks, statistical clerks 100
Airline traffic agents and clerks 297
Assignment clerks, statistical clerks 100
Bank clerks 114
Billing clerks, merchant marine industry .. 745
Check-out clerks, cashiers 89
Claim clerks, trucking industry 759
Classification clerks, statistical clerks 99
Clerk-typists 105
Coding clerks, statistical clerks 99
Control clerks, bank clerks 115
Counter clerks, laundry and drycleaning .. 784
County collection clerks, bank clerks 115
Demurrage clerks, statistical clerks 100
Distribution clerks, postal clerks 94
Exchange clerks, *see:* Bank clerks 115
Interest clerks, bank clerks 115
Inventory clerks, stock clerks 101

Law clerks, lawyers 143
Mail clerks 94
Manifest clerks, merchant marine industry 745
Manifest clerks, trucking industry 759
Medical record clerks 492
Mortgage clerks, bank clerks 115
Mortgage clerks, typists 105
Parts-order clerks, trucking industry 759
Personnel clerks, statistical clerks 99
Postal clerks 94
Posting clerks, statistical clerks 99
Procurement clerks, stock clerks 101
Railroad clerks 307
Rate clerks, trucking industry 759
Receipt clerks, merchant marine industry . 745
Receiving clerks, shipping and receiving clerks 97
Report clerks, merchant marine industry . 745
Reservation agents and clerks, airline 297
Reservation clerks, hotel 91
Room and desk clerks, hotel 91
Sales clerks, retail trade 235
Shipping and receiving clerks 97
Stock clerks 101
Stock clerks, motor vehicle and equipment manufacturing 707
Traffic agents and clerks 297
Transit clerks, bank clerks 115
Waybill clerks, typists 105
Window clerks, postal clerks 94

Climatologists, *see:* Meteorologists 357
Clinical dietitians 517
Clinical laboratory workers 489
Clinical psychologists 564
Clothing industry occupations, *see:* Apparel industry 654
Coal loading machine operators 631
Coal mining 630
Coding clerks, statistical clerks 99
Coil winders, electronics manufacturing 681
Coiler operators, aluminum industry 651
College and university teachers 208
College career planning and placement counselors 550
College librarians 213
College placement officers, *see:*
College career planning and placement counselors 550
College student personnel workers 135
College student personnel workers 134
College union staff members 135

Color technicians, *see:* Photographic laboratory occupations 71
Commercial account underwriters 126
Commercial artists 589
Commercial photographers 602
Commercial tellers, banking 117
Communications and related occupations 606
Community planners 604
Companions, *see:* Private household workers .. 176
Composing room occupations, printing 40
Composition roofers 277
Compositors, printing, *see:*
Printing occupations 40
Printing and publishing 550
Compounders, *see:* Drug industry 676
Compressors, *see:* Drug industry 676
Computer and related occupations 107
Computer manufacturing 711
Computer operating personnel 107
Computer operators, *see:* Computer operating personnel 107
Computer programmers, *see:* Paper and allied products industry 719
Computer salesmen, office machine and computer manufacturing 712
Computer service technicians 426
Computers, prospecting, petroleum and natural gas 635
Concrete finishers 254
Conductors, railroad 307
Conservation occupations 332
Conservationists, range, *see:* Range managers . 335
Conservationists, soil 337
Console operators, *see:* Computer operating personnel 107
Construction 629
Construction electricians 258
Construction inspector (government) 195
Construction laborers 256
Construction machinery operators, *see:* Operating engineers 269
Construction occupations 245
Continuity directors, radio and television 748
Continuity writers, radio and television 748
Continuous mining machine operators 631
Control clerks, *see:* Bank clerks 115
Control room operators, electric power 736
Conveyor men, coal mining 631
Cooks, *see:* Private household workers 176
Cooks and chefs 163
Cooks' helpers, *see:* Private household workers 176
Cooperative extension service workers 559

See also: Home economists 561
Copilots 294
Core assemblers, foundries 485
Core-oven assemblers, foundries 685
Coremakers, *see:*
Foundries 685
Foundry occupations 29
Motor vehicle and equipment manufacturing 706
Coresetters, foundries 685
Corn and wheat farmers 622
Correspondent bank officers 116
Cosmetologists 171
Construction inspectors (government) 195
Cotton farmers 623
Counseling occupations 554
Counseling psychologists, *see:* Psychologists .. 564
Counselors, *see:*
College student personnel workers 135
Employment counselers 546
Rehabilitation counselers 548
School counselers 544
Counter clerks, laundry and drycleaning 784
Counters, paper and allied products 718
Country collection clerks, *see:* Bank clerks 115
County extension workers 559
Court reporters 103
Crane operators, *see:*
Foundries 685
Motor vehicle and equipment manufacturing 707
Operating engineers 269
Trucking industry 759
Cranemen, *see:* Forge shop occupations 62
Credit managers 137
Credit officials 137
Crew chiefs, aircraft, missile, and space craft .. 646
Crew schedulers, statistical clerks 100
Crop specialty farmers 623
Crystal finishers, electronics manufacturing ... 681
Crystal grinders, electronics manufacturing ... 681
Cushion builders, motor vehicle and equipment manufacturing 707
Custodians, building 155
Customer engineers, computer service technicians 426
Customer service occupations, electric power .. 741
Customers brokers, *see:* Securities salesworkers 426
Customs inspectors 191
Cutters, apparel 655
Cutters, motor vehicle and equipment manufacturing 707
Cutting machine operators 631

Dairy farmers 621
Dampproof workers, *see:* Roofers 277
Dancers 578
Darkroom technicians, *see:* Photographic laboratory occupations 70
Data typists, *see:* Computer operating personnel 107
Day workers, *see:* Private household workers .. 176
Dean of students, *see:* College student personnel workers 135
Deck-engine mechanics, *see:* Merchant seamen 302
Deck officers, *see:*
Merchant marine industry 743
Merchant marine officers 298
Deck utilitymen, *see:* Merchant seamen 302
Deckmen, lumber mills 701
Decontamination men, atomic energy 666
Decorators, interior 597
Dehydration-plant operators, petroleum and natural gas 636
Deliverymen, *see:* Routemen 237
Demurrage clerks, statistical clerks 100
Dental assistants 467
Dental hygienists 469
Dental laboratory technicians 471
Dental occupations 465
Dentists 465
Derrickmen, petroleum and natural gas 635
Derrickmen, *see:* Stonemasons 281
Design occupations 586
Designers, apparel 654
Designers, floral 593
Designers, industrial 595
Designers, interior 597
Designers, scenic, interior designers and decorators 748
Detailers, *see:* Draftsmen 389
Detectives 185
Developers, *see:* Photographic laboratory occupations 71
Development engineers, radio and television ... 749
Die makers, *see:*
Aluminum industry 652
Electronics manufacturing 681
Machining occupations 38
Office machine and computer manufacturing 713
Die makers, tool-and 38
See also listing under Tool-and-die makers.
Die sinkers, forge shop 63

Diesel mechanics 428
Dietetic educators 517
Dietitians 517
Digester operators, paper and allied products .. 717
Directors, program, radio and television 748
Directory assistance operators 200
Dispatchers, *see:*
  Airline dispatchers 289
  Trucking industry 759
Dispensing opticians and optical mechanics ... 716
  See also: Optometrists 475
Displaymen (retail trade) 591
Distribution clerks, postal clerks 94
District representatives, electric power 741
Dividermen, baking industry 669
Doctors, medical 479
Dough molders, baking 669
Draftsmen 389
  See also:
    Aluminum industry 652
    Electronics manufacturing 680
    Industrial chemicals 688
    Iron and steel industry 697
    Motor vehicle and equipment manufacturing 706
    Office machine and computer manufacturing 712
    Petroleum and natural gas production and processing 635
    Petroleum refining 723
Dragline operators, coal mining 631
Dressmakers, apparel 656
Drilling machine operators 631
Driver-salesmen, *see:*
  Baking industry 670
  Routemen 237
Drivers, intercity buses 315
Drivers, local transit buses 317
Drivers, local trucks 319
Drivers, taxi 325
Driving occupations 315
Drug industry, occupations in the 674
Druggists 523
Drycleaners, laundry and drycleaning 785
Drycleaning plants 784
Drycleaning routemen 237
Dry-kiln operators, lumber mills 702
Duplicating machine operators 93

Earth-boring machine operators, *see:* Operating engineers 269
Ecologists, *see:* Life scientists 366
Ecologists, range, *see:* Range managers 335
Economic geographers 536
Economic geologists 352
Economists 532
  See also: Statisticians 374
Economists, agricultural 324
Edgermen, lumber mills 701
Editors, film, television 749
Education and related occupations 203
EEG technicians 485
Egg products inspectors 190
EKG technicians 485
Electric power linemen 739
Electric power industry, occupations in the 734
Electric sign servicemen 433
Electrical appliance servicemen 413
Electrical engineers 346
  See also:
    Aluminum industry 652
    Electronics manufacturing 675
    Industrial chemical industry 687
    Iron and steel industry 697
    Motor vehicle and equipment manufacturing 706
    Paper and allied products industry ... 434
Electrical inspectors 196
Electrical repairmen, maintenance electricians . 444
Electrical repairmen, *see:* Iron and steel industry ..... 69[illegible]
Electrical workers, *see:* Shop trades, railroads . 310
Electricians, construction 258
Electricians, maintenance 444
  See also listing under Maintenance electricians.
Electricians, merchant marine industry 744
Electrocardiograph technicians 485
Electroencephalographic technicians 486
Electronic assembly inspector, *see:*
  Electronics manufacturing 681
  Office machine and computer manufacturing 713
Electronic computer programmers 109
Electronic organ technicians 449
Electronic reader-sorter operators, *see:* Bank clerks 115
Electronic specialists, *see:* Oceanographers 360
Electronics checkout men, aircraft, missile, and spacecraft 646
Electronics engineers, *see:* Electronics manufacturing 679
Electronics manufacturing 679
Electronics mechanics, aluminum 651

Electronics repairmen, iron and steel 696
Electronics subassembly inspectors, *see:* Office machine and computer manufacturing ... 713
Electronics technicians 392
See also:
Electronics manufacturing 680
Engineering and science technicians .. 392
Office machine and computer manufacturing 713
Electroplaters 58
See also:
Electronics manufacturing 681
Motor vehicle and equipment manufacturing 707
Electrotypers and stereotypers, *see:*
Printing occupations 43
Printing and publishing 726
Elementary school teachers 204
Elevator constructors 260
Elevator mechanics 260
Embalmers 173
Embossing machine operators 93
Embryologists 366
Employment aides, *see:* Social service aides ... 569
Employment counselors 546
Encoders, bank clerks 115
Engine mechanics, aircraft, missile, and spacecraft 646
Engineering aides, *see:*
Electronics manufacturing 680
Office machine and computer manufacturing 712
Engineering and science technicians 391
Engineering geologists 352
Engineering technicians 652
Engineers 339
See also:
Aeronautical engineers 342
Aerospace engineers 342
Agricultural engineers 343
Astronautical engineers 342
Biomedical engineers 343
Ceramic engineers 344
Chemical engineers 345
Civil engineers 345
Electrical engineers 346
Electronics engineers 679
Industrial engineers 347
Mechanical engineers 348
Metallurgical engineers 349
Mining engineers 350
Oceanographic engineers 360
Petroleum engineers, petroleum and natural gas 635
Safety engineers 635
Engineers, development, radio and television .. 749
Engineers, flight 292
Engineers, foundries 685
Engineers, insurance 776
Engineers, locomotive 308
Engineers, motor vehicle and equipment manufacturing 706
Engineers, petroleum 635
Engineers, stationary 75
Enginemen, petroleum and natural gas 635
Entomologists, agriculture 625
Envelope-machine operators, paper and allied products 718
Environmental health technicians 525
Environmental sciences 352
Environmentalists 525
Etching equipment operators, electronics manufacturing 681
Ethnologists, *see:* Anthropologists 529
Exchange clerks, *see:* Bank clerks 115
Exhaust operators, electronics manufacturing . 681
Experimental machinists, *see:* Instrument makers (mechanical) 33
Exploration geophysicists 355
Extension service workers 559
Exterminators 156
Extras, *see:* Actors and actresses 576
Extrusion press operators, aluminum industry . 651

Fabrication inspectors, aircraft, missile, and spacecraft 646
Face boss, *see:* Coal mining 631
Fallers, logging 701
Family service workers, *see:* Social workers ... 571
Farm equipment mechanics 435
Farm managers 625
Farm service jobs 627
Farmers, *see:* Agriculture 619
Fashion models 228
FBI special agents 175
Federal civilian government 789
Federal Government occupations 789
Field engineers, *see:* Computer service technicians 426
Field technicians, radio and television 387
File clerks 90
Film editors, television 749
Film librarians, television 749

Film numberers, *see:* Photographic laboratory technicians 71
Film strippers, *see:* Photographic laboratory technicians 71
Final assemblers, aircraft, missile, and spacecraft 645
Finance, insurance, and real estate 771
Finishers, flatwork, laundry and drycleaning .. 785
Finishers, men's suit, laundry and drycleaning . 785
Finishers, optical mechanics 431
Finishers, shirt, laundry and drycleaning 785
Fire boss, *see:* Coal mining 631
Firefighters 181
Firemen, *see:* Firefighters 181
Firemen, locomotive 309
Firemen, stationary (boiler) 77
Firemen/watertenders, *see:*
Merchant marine industry 744
Merchant seamen 302
First assistant engineers, merchant marine officers 299
First mates, merchant marine officers 298
Fitters, apparel 655
Fitters, see: Coal mining 631
Fitup men, boilermaking occupations 577
Flatwork finishers, laundry and drycleaning ... 785
Flight attendants 290
Flight engineers 292
Flight service station specialists 293
Flight superintendents, *see:* Airline dispatchers 289
Floor assemblers 50
Floor coremakers, foundry 29
Floor covering installers 261
Floor covering mechanics 261
Floor layers, *see:* Floor covering installers 261
Floor molders, foundry occupations 28
Floormen, television 748
Food and drug inspectors 189
Floral designers 593
Food processing technicians 396
Food scientists 381
Food service occupations 161
Food technologists 381
Foremen 60
Foresters 332
See also:
Agriculture 625
Logging and lumber mills 701
Paper and allied products 719
Forestry aides and technicians 334
Forestry technicians, *see:* Forestry aides and technicians 334
Forge shop occupations 61
Forklift truck operators, *see:*
Electronics manufacturing 681
Power truck operators 73
Foundries 684
Foundry occupations 26
Framemen, telephone central office craftsmen . 405
Free-lance models 228
Free-lance photgraphers 602
Front-end mechanics, *see:* Automobile mechanics 417
Front-office cashiers 89
Front-office clerks, hotel 91
Funeral directors and embalmers 173
Fur cutters, apparel 656
Fur finishers, apparel 657
Fur machine operators, apparel 657
Fur nailers, apparel 657
Furnace installers, heating mechanics 411
Furnace operators, foundries 685
Furniture upholsterers 64

Gagers, petroleum and natural gas 636
Garage mechanics, *see:* Automobile mechanics 417
Gas appliance servicemen 411
Gas burner mechanics 411
Gas dispatchers 100
Gas fitters, *see:* Plumbers and pipefitters 275
Gas welders 81
Gas-compressor operators, petroleum and natural gas 636
Gasoline-plant operators, petroleum and natural gas 636
Gasoline service station attendants 224
Gasoline station salesmen 224
Gasoline station servicemen 224
General boardmen, *see:* Commercial artists ... 770
General bookkeepers 87
General maids, *see:* Private household workers 176
Geneticists, agriculture 625
Geochemists, *see:* Geologists 352
Geochronologist, *see:* Geologists 353
Geodesists, *see:* Geophysicists 355
Geographers 535
Geological oceanographers 353
See also: Oceanographers 360
Geologists 352
See also: Petroleum and natural gas production and processing 635
Geomagneticians, *see:* Geophysicists 355
Geophysicists 354
See also: Petroleum and natural gas production and processing 635

Glass blowers, electronics manufacturing 681
Glass lathe operators, electronics manufacturing 681
Glaziers 264
Governesses, *see:* Private household workers .. 176
Government 787
Government occupations, Federal 9
See also: Postal service 793
Government occupations, State and local 797
Graders, lumber mills 702
Grain farmers, *see:* Corn and wheat farmers ... 622
Granulator-machine operators, *see:* Drug industry 676
Gravure photoengravers, printing and publishing 726
Grid lathe operators, electronics manufacturing 681
Grinders, *see:*
Forge shops 63
Foundries 685
Grocery clerks, *see:* Cashiers 89
Ground radio operators and teletypists 293
Groundmen, electric power 740
Guards and watchmen 183
Guidance counselors 544

Hairdressers 171
Hairstylists, *see:* Barbers 169
Hammermen, *see:*
Forge shop 62
Motor vehicle and equipment manufacturing 706
Hammersmiths, forge shop 62
Hand assemblers, office machine and computer manufacturing 713
Hand compositors, printing 40
Hand icers, baking 670
Hand molders, foundries 685
Hand sewers, apparel 656
Hand spreaders, apparel 655
Handymen, *see:* Private household workers ... 176
Head sawyers, lumber mills 609
Health and regulatory inspectors (government) 189
Health insurance agents 226
Health physicists, atomic energy 665
Health physics technicians, atomic energy 665
Health occupations 461
Heat treaters, *see:*
Aircraft, missile, and spacecraft manufacturing 645
Forge shop 63
Foundries 685
Heaters, *see:*
Forge shop 63
Iron and steel industry 695
Motor vehicle and equipment manufacturing 706
Heating mechanics 411
Helpers, baking 670
Helpers, iron and steel 694
High school teachers 206
High speed printer operators, *see:* Computer operating personnel 107
Highway patrolmen, *see:* State police officers .. 187
Historians 534
Hod carriers 257
See also:
Bricklayers 250
Plasterers 274
Home economists 560
Home health aides, *see:* Nursing aides 505
Home housekeepers, *see:* Private household workers 176
Homemaker aides, *see:* Social service aides ... 568
Horticulturists 365
Hospital administrators 519
Hospital attendants 505
Hospital nurses 501
Hostess-cashiers 89
Hot-cell technicians, atomic energy 666
Hot metal cranemen, *see:* Aluminum industry . 650
Hotel front-office clerks 91
Hotel housekeepers and assistants 159
Hotel managers and assistants 139
Hotels 781
Household workers, *see:* Private household workers 176
Housekeepers, *see:* Private household workers . 177
Housekeepers and assistants, hotel 159
Housemen, *see:* Private household workers 176
Human nutritionists, *see:* Agriculture 625
Hydrogen furnace operators, electronics manufacturing 681
Hydrologists, *see:* Geophysicists 355
Hygienists, dental 469

Icing mixers, baking 670
Illustrators, *see:* Commercial artists 589
Information science specialists librarians 213
Immigration inspectors 191
Industrial chemical industry, occupations in the 687
Industrial designers 595
See also: Electronics manufacturing 680
Industrial engineers 347

See also:
Aluminum industry 652
Apparel industry 657
Drug industry 676
Electronics manufacturing 679
Motor vehicle and equipment manufacturing 706
Office machine and computer manufacturing 712
Industrial machinery repairmen 437
Industrial meteorologists 357
Industrial nurses 502
Industrial photographers 602
Industrial production and related occupations . 25
Industrial technicians 393
Industrial traffic managers 140
Infants' nurses, *see:* Private household workers 176
Informal models 228
Information science specialists 213
Infrared oven operators, electronics manufacturing 681
Ingot strippers, iron and steel 694
Inhalation therapists 499
Inside adjusters, claim examiners 124
Inspectors, construction 195
Inspectors, laundry and drycleaning 785
Inspectors, (manufacturing) 66
See also:
Apparel industry 656
Electronics manufacturing 689
Forge shop 63
Motor vehicle and equipment manufacturing 707
Inspectors, quarantine 190
Installation men, *see:* Automobile trimmers (automobile upholsterers) 54
Instrument makers (mechanical) 33
Instrument repairmen 438
See also:
Drug industry 676
Industrial chemical industry 688
Paper and allied products industry ... 718
Petroleum and natural gas production and processing 636
Instrument technicians, *see:*
Engineering and science technicians 393
Mechanical technicians 393
Instrumentmen, *see:* Surveyors 399
Insulating workers 248
Insurance agents and brokers 226
Insurance industry 775
Insurance occupations 119
Insurance salespeople, underwriters 125
Intercity busdrivers 315
Interest clerks, *see:* Bank clerks 115
Interior decorators 597
Interior designers 597
International officers, banking 116
Interpreters 606
Intertype machine operators, printing 40
Inventory clerks, *see:* Stock clerks 101
Investigators, FBI 175
Investment analysts, *see:* Insurance industry ... 776
Iron and steel industry, occupations in the 692
Iron workers, building trades 282

Janitors, *see:* Building custodians 155
Jewelers 440
Jig and fixture builders, aircraft, missile, and spacecraft 645
Junior typists 105

Keepers, iron and steel 697
Keypunch operators 107
Kindergarten teachers 204

Laboratory assurance technicians, *see:* Food processing technicians 396
Laboratory analysts, *see:* Food processing technicians 396
See also:
Aluminum industry 652
Drug industry 676
Electronics manufacturing 680
Industrial chemical industry 688
Iron and steel industry 697
Petroleum refining 723
Laboratory technicians, dental 471
Laborers, construction, building trades 256
Ladle cranemen, iron and steel 694
Landmen, petroleum and natural gas 635
Landscape architects 595
Larrymen, iron and steel 693
Lathe operators, motor vehicle and equipment manufacturing 706
Lathers 265
Laundresses, *see:* Private household workers .. 176
Laundry and drycleaning plants 784
Law clerks, *see:* Lawyers 143
Lawyers 141
See also: Insurance industry 776
Layout artists, *see:* Commercial artists 589
Layout men, boilermaking occupations 56
Layout workers, advertising 131

Leasemen, petroleum and natural gas 635
Legal secretaries 103
Lens grinder, *see:* Optical mechanics 431
Letterers, *see:* Commercial artists 589
Librarians 212
Librarians, acquisition 213
Librarians, adult services 213
Librarians, children's 213
Librarians, medical record 521
Librarians, university 213
Library occupations 212
Library technical assistants 215
Licensed practical nurses 504
Licensed vocational nurses 504
Life insurance agents 226
Life science occupations 363
Life scientist 365
Lighting technicians, television 387
Linemen, *see:*
  Electric power industry 739
  Telephone industry 407
Linemen and cable splicers, telephone 407
Linotype operators, printing 40
Lithographic artists, printing 45
Lithographic occupations, printing 45
Lithographic pressmen, printing 45
Livestock farmers 621
Load dispatchers, electric power 739
Loader engineers, logging 701
Loading machine operators, *see:* Coal mining . 631
Loan officers, *see:*
  Bank officers 116
  Credit officials 137
Local government occupations 797
Local transit busdrivers 317
Local truckdrivers, *see:*
  Driving occupations 319
  Trucking industry 758
Locksmiths 442
Locomotive engineers, railroad 308
  See also: Iron and steel industry 696
Locomotive firemen, railroad 309
Loggers 700
Logging and lumber mills 700
Long-distance truckdrivers 321
Longshoremen 744
Longwall machine operators, *see:* Coal Mining 631
Lubrication men, *see:* Trucking industry 759
Lumbermen 700

Machine coremakers, foundry occupations 29
Machine designers, *see:* Mechanical technicians 393
Machine icers, baking 70
Machine modlers, *see:*
  Foundries 685
  Foundry occupations 28
  Motor vehicle and equipment manufacturing 706
Machine movers, *see:* Riggers and movers 282
Machine spreaders, apparel 655
Machine tool operators 35
  See also:
    Aircraft, missile, and spacecraft manufacturing 645
    Electronics manufacturing 681
    Motor vehicle and equipment manufacturing 706
Machined parts inspectors, *see:*
  Aircraft, missile, and spacecraft manufacturing 646
  Office machine and computer manufacturing 713
Machinery repairmen, industrial 437
Machining occupations 31
Machinists, all-round 31
  See also:
    Aircraft, missile, and spacecraft manufacturing 645
    Drug industry 676
    Electronics manufacturing 681
    Instrument makers (mechanical) 33
    Railroad shop trades 310
Mail carriers 199
Mail clerks 94
Mail handlers 94
Mail preparing and mail handling machine operators, office machine operators 93
Mailmen, mail carriers 199
Maintenance electricians 444
  See also:
    Aluminum industry 652
    Coal mining 631
    Drug industry 676
    Electronics manufacturing 681
    Industrial chemicals industry 688
    Iron and steel industry 696
    Office machine and computer manufacturing 713
    Paper and allied products industry ... 718
    Petroleum and natural gas production and processing 636
Maintenance machinists, *see:*
  Aluminum industry 652
  Electronics manufacturing 681

Paper and allied products industry 718
Maintenance mechanics, *see:* Industrial machinery repairmen 437
Maintenance technicians, radio and television . 387
Maintenance welders 81
See also:
Aluminum industry 652
Electronics manufacturing 681
Makeup artists, television 748
Makeup men, printing and publishing 726
Managers, city 132
Managers, industrial traffic 140
Managers, range 335
Managers and assistants, hotel 139
Manifest clerks, *see:*
Merchant marine industry 745
Trucking industry 759
Manipulator operators, iron and steel 695
Manufacturers' salesworkers 230
Manufacturing 641
Marble setters, tilesetters, and terrazzo workers 266
Marine biologists, *see:* Oceanographers 360
Marine engineers 744
Marine geologists, *see:* Oceanographers 360
Markers, apparel 655
Markers, laundry and drycleaning 784
Marketing research workers 144
Masons, brick 250
Masons, cement and concrete 255
Masons, stone 280
Masters, *see:*
Merchant marine industry 743
Merchant marine officers 298
Material handlers, apparel 655
Material handlers, *see:*
Motor vehicle and equipment manufacturing 707
Trucking industry 759
Mates, *see:* Merchant marine officers 298
Mathematical assistants, electronics manufacturing 680
Mathematical statisticians 371
Mathematicians 371
See also:
Electronics manufacturing 679
Motor vehicle and equipment manufacturing 706
Office machine and computer manufacturing 712
Mathematics occupations 371
Meat and poultry inspectors 190
Meat cutters 165
See also: Retail food stores 768
Meat wrappers, *see:* Retail food stores 768
Mechanical artists, commercial artists 589
Mechanical engineers 348
See also:
Aluminum industry 642
Atomic energy field 662
Coal mining 632
Drug industry 676
Electronics manufacturing 679
Industrial chemical industry 687
Iron and steel industry 696
Motor vehicle and equipment manufacturing 706
Office machine and computer manufacturing 712
Paper and allied products industry ... 719
Mechanical inspectors 196
Mechanical technicians 393
Mechanic-attendants, *see:* Gasoline service station attendants 224
Mechanics, *see:*
Air-conditioning mechanics 411
Aircraft mechanics 287
Automobile mechanics 417
Boat motor mechanics 420
Bowling-pin-machine mechanics 422
Bus mechanics 454
Diesel mechanics 428
Dispensing opticians and optical mechanics 431
Farm equipment mechanics 435
Gas burner mechanics 510
Heating mechanics 510
Motorcycle mechanics 446
Oil burner mechanics 411
Refrigeration mechanics 411
Truck mechanics 454
Vending machine mechanics 457
Mechanics and repairmen 403
Media directors, advertising 131
Medical assistants 488
Medical laboratory assistants 489
Medical laboratory technicians 489
Medical laboratory workers 489
Medical microbiologists 366
Medical practitioners 473
Medical record administrators 521
Medical record librarians 521
Medical record technicians and clerks 492
Medical sales representatives, *see:* Pharmacists 523
Medical secretaries 106
Medical social workers 571

Medical technicians, technologists, and assistant occupations ... 485
Medical technologists ... 489
Medical X-ray technicians ... 497
Melters, *see:*
Iron and steel industry ... 694
Motor vehicle and equipment manufacturing ... 706
Men's suit finishers, laundry and drycleaning ... 785
Merchant marine industry ... 743
Merchant marine occupations ... 298
Merchant marine officers ... 298
Merchant seamen ... 301
Messmen, *see:*
Merchant marine industry ... 744
Merchant seamen ... 302
Metal finishers, motor vehicle and equipment manufacturing ... 707
Metal patternmakers, foundry occupations ... 26
Metal roofers ... 27
Metallurgical engineers ... 349
See also: Iron and steel industry ... 697
Metallurgists, *see:*
Aluminum industry ... 652
Electronics manufacturing ... 679
Foundries ... 685
Iron and steel industry ... 696
Motor vehicle and equipment manufacturing ... 706
Meteorological instrumentation specialists ... 357
Meteorologists ... 357
Meter installers, electric power ... 741
Meter readers, electric power ... 741
Meter repairmen, electric power ... 741
Meter testers, electric power ... 741
Metermen, electric power ... 741
Microbiologists, *see:*
Agriculture ... 625
Drug industry ... 675
Life sciences ... 366
Millwrights ... 67
See also:
Aluminum industry ... 652
Iron and steel industry ... 696
Motor vehicle and equipment manufacturing ... 708
Paper and allied products industry ... 718
Mine inspectors ... 192
Mineralogists, *see:*
Geologists ... 352
Petroleum and natural gas ... 635
Mining and petroleum industry ... 629
Mining engineers ... 350
See also: Coal mining ... 632
Ministers, Protestant ... 553
Missile assembly mechanics, aircraft, missile, and spacecraft ... 645
Missile manufacturing occupations ... 643
Mixers, baking ... 669
Models ... 228
Modelmakers, see:
Instrument makers (mechanical) ... 33
Motoring vehicle and equipment manufacturing ... 704
Molders, *see:* Foundry occupations ... 28
Molders' helpers, foundries ... 685
Molding machine operators, baking industry ... 669
Monitors, radiation, atomic energy ... 665
Monotype caster operators, printing ... 41
Monotype keyboard operators, printing ... 41
Mortgage clerks, *see:*
Bank clerks ... 115
Typists ... 105
Mothers' helpers, *see:* Private household workers 176
Motion picture projectionists ... 69
Motorcycle mechanics ... 446
Motor vehicle and equipment manufacturing occupations ... 704
Motor vehicle body repairmen ... 415
Music directors, radio and television ... 748
Music librarians, radio and television ... 748
Musicians ... 581

Natural gas production and processing ... 635
Neighborhood workers, *see:* Social service aides 569
Neon sign servicemen ... 433
News directors, radio and television ... 748
Newscasters, radio and television ... 748
Newspaper reporters ... 609
Newswriters, radio and television ... 748
Note tellers, banking ... 117
Nuclear reactor operators, atomic energy ... 665
Nurse educators, *see:* Registered nurses ... 502
Nursemaids, *see:* Private household workers ... 176
Nurses, industrial ... 502
Nurses, licensed practical ... 504
Nurses, licensed vocational ... 504
Nurses, occupational health ... 502
Nurses, office ... 502
Nurses, private duty ... 502
Nurses, public health ... 502
Nurses, registered ... 501
Nursing aides, orderlies, and attendants ... 505
Nursing assistants, *see:* Nursing aides ... 505

Nursing occupations 501
Nutritionists 366
See also:
Dietitians 517
Home economists 561

Observers, petroleum and natural gas 635
Occupational health nurses 502
Occupational therapists 508
Occupational therapy assistants 510
Oceanographers 359
Oceanographic engineers, *see:* Oceanographers 360
Odd-job men, *see:* Private household workers .. 176
Office machine and computer manufacturing .. 711
Office machine operators 92
Office machine servicemen 423
Office nurses 502
Office occupations 85
Oil burner mechanics 411
Oilers, *see:*
Merchant marine industry 744
Merchant seamen 302
Operating engineers, construction machinery .. 269
Operating room technicians 494
Operatings agents, airline 297
Operations officers, banking 116
Operators, resistance welding 81
Operators, telephone 200
Opthalmologists 475
Optical laboratory technicians 431
Optical mechanics 431
Opticians, dispensing 431
Optometric assistants 496
Optometrists 475
Oral surgeons, *see:* Dentists 465
Orderlies, *see:* Nursing aides 505
Ordinary seamen, *see:*
Merchant marine industry 743
Merchant seamen 301
Organ servicemen 448
Ornamental-iron workers, building trades 282
Orthodontists, *see:* Dentists 465
Osteopathic physicians 476
Outside production inspectors, aircraft, missile, and spacecraft 646
Ovenmen, baking 669
Overburden stripping operators, *see:* Coal mining 631
Oxygen cutters 81
Oxygen furnace operators, iron and steel 694

Packaging engineers, paper and allied products 719
Packers, baking industry 670
Painters, automobile 51
Painters, production 74
See also: Aircraft, missile, and spacecraft manufacturing 645
Painters and paperhangers 271
Paleomagneticians *see:* Geophysicists 355
Paleontologists, *see:*
Geologists 352
Petroleum and natural gas 635
Paper and allied products industries 716
Paper chemists, paper and allied products 719
Paper machine operators, paper and allied products 717
Paper sorters and counters, paper and allied products 718
Paperhangers 271
Parking attendants 324
Parole officers, *see:* Social workers 571
Parts countermen, automobile 219
Parts-order clerks, *see:* Trucking industry 759
Party chiefs, surveyors 399
Paste-up men, *see:*
Commercial artists 589
Printing occupations 41
Pathologists 366
See also:
Drug industry 676
Medical laboratory workers 489
Pathologists, speech 514
Patrolmen, *see:*
Police officers 185
State police officers 187
Pattern graders, apparel 655
Patternmakers, apparel 655
Patternmakers, *see:*
Foundries 685
Foundry occupations 26
Motor vehicle and equipment manufacturing 706
PBX installers and repairmen, telephone 409
PBX operators, *see:* Telephone operators 201
PBX repairmen 410
Peanut farmers 623
Perforator operators, petroleum and natural gas 637
Performing arts 576
Personal maids, *see:* Private household workers 176
Personal service occupations 169
Personnel clerks 99
Personnel workers 146
Petroleum and natural gas production and processing 634

Petroleum engineers, *see:* Petroleum and natural gas production and processing 636
Petroleum geologists 352
See also: Petroleum and natural gas production and processing 635
Petroleum refining 722
Petrologists, petroleum and natural gas production and processing 635
Pharmacists 523
See also: Drug industry 676
Pharmaceutical detailmen, *see:* Drug industry 676
Pharmaceutical operators, *see:* Drug industry . 676
Pharmacologists, *see:*
Drug industry 675
Life scientists 366
Photocheckers and assemblers, *see:* Photographic laboratory occupations 71
Photoengravers, printing, *see:*
Printing occupations 46
Printing and publishing 726
Photogeologists, *see:* Petroleum and natural gas production and processing 635
Photographers 602
Photographic laboratory occupations 70
Photographic models, *see:* Models 228
Photographic technicians 712
Phototypesetting machine operators, printing 41
Physical distribution managers, *see:* Industrial traffic managers 140
Physical geographers 536
Physical meteorologists 357
Physical oceanographers 360
Physical scientists 377
Physical-science aides, *see:* Food processing technicians 396
Physical therapists 511
Physical therapy assistants and aides 512
Physicians 479
Physicists 383
See also:
Electronics manufacturing 679
Office machine and computer manufacturing 712
Physicists, health, atomic energy 665
Physiologists, *see:* Drug industry 675
Piano and organ servicemen 448
Piano technicians 448
Piano tuners 448
Picklers, forge shop 63
Piercer machine operators, iron and steel 695
Pill and tablet coaters, drug industry 676
Pilots and copilots 294
Pinsetting machine mechanics, *see:* Bowling-pin-machine mechanics 422
Pipefitters 275
See also:
Drug industry 676
Industrial chemical industry 688
Iron and steel industry 696
Motor vehicle and equipment manufacturing 708
Paper and allied products industry ... 718
Pipe-organ technicians 449
Placement counselers, college 550
Plainclothesmen, *see:* Police officers 185
Planer mill operators, lumber mill 702
Planer operators, lumber mill 702
Planetologists, *see.* Geophysicists 355
Planners, urban 604
Planning counselors, college 550
Plant facilities technicians, *see:* Food processing technicians 387
Plant quarantine and plant pest control inspectors, *see:* Agriculture 625
Plant scientists, *see:* Agriculture 625
Plasterers 273
Platemakers, printing, *see:*
Printing occupations 45
Printing and publishing 726
Platers, electroplaters 58
See also: Aircraft, missile, and spacecraft manufacturing 645
Plumbers and pipefitters 275
See also:
Aluminum industry 652
Motor vehicle and equipment manufacturing 708
Podiatrists 481
Police officers 185
Policemen, *see:*
Police officers 185
State police officers 187
Policewomen 185
Policy checkers, *see:* Statistical clerks 100
Policy writers, *see:* Typists 105
Polishers, motor vehicle and equipment manufacturing 707
Political geographers 536
Political scientists 538
Pondmen, lumber mills 701
Portrait photographers 602
Postal clerks 94
See also: Postal service occupations 785
Postal inspectors 785

Postal service occupations 793
Posting clerks, *see:* Statistical clerks 99
Postmasters 785
Pot liners, *see:* Aluminum industry 649
Potmen, *see:* Aluminum industry 649
Poultry farmers 622
Pourers, *see:*
  Foundries 685
  Iron and steel industry 695
  Motor vehicle and equipment manufacturing 706
Power dispatchers, electric power 739
Power hammer operators, aircraft, missile, and spacecraft 643
Power linemen, electric power 739
Power shear operators, aircraft, missile, and spacecraft 644
Power truck operators 73
  See also:
    Motor vehicle and equipment manufacturing 707
    Trucking industry 759
Powerplant occupations, electric power 736
Practical nurses 504
Precision assemblers, electronics 680
Preparation plant central control operators, *see:* Coal mining 631
Press operators, forge shop 62
Press photographers 602
Pressers, apparel 656
Pressmen, printing, *see:*
  Printing occupations 48
  Printing and publishing 726
Priests, Roman Catholic 556
Print developers, machine, *see:* Photographic laboratory occupations 71
Printer operators, *see:* Photographic laboratory occupations 71
Printer-slotter operators, paper and allied products 718
Printers, *see:* Photographic laboratory occupations 71
Printing and publishing 725
Printing occupations 40
Printing pressmen and assistants, *see:*
  Printing occupations 48
  Printing and publishing 726
Private duty nurses 502
Private household service occupations 176
Private outdoor recreation farmers 624
Probation and parole officers, *see:* Social workers 571
Process engineers, paper and allied products ... 719
Process metallurgists, *see:* Aluminum industry . 652
Producers, assistants, radio and television 748
Procurement clerks, *see:* Stock clerks 101
Produce clerks, *see:* Retail food stores 767
Producer-directors, program, radio and television 748
Production managers, advertising 131
Production managers, apparel 657
Production painters 74
  See also: Aircraft, missile, and spacecraft manufacturing 645
Production planners, aircraft, missile, and spacecraft 644
Production technicians, *see:*
  Engineering and science technicians 393
  Industrial engineering 393
  Printing and publishing 726
Professional modelers, *see:* Industrial designers 595
Program assistants, radio and television 748
Program directors, radio and television 748
Programmers, electronic computer 109
  See also: Office machine and computer manufacturing 712
Proof machine operators, *see:* Bank clerks 114
Proofreaders, printing and publishing 726
Property and liability insurance agents and brokers 226
Protective and related service occupations 175
Protestant ministers 553
Psychiatric aides, *see:* Nursing aides 505
Psychiatric social workers 571
Psychologists 563
Public health nurses 502
Public health sanitarians, *see:* Sanitarians 525
Public librarians 212
Public relations workers 147
Public works inspectors 196
Pumpers, petroleum and natural gas 441
Pumpmen, petroleum refining 723
Punch press operators, *see:*
  Aircraft, missile, and spacecraft manufacturing 643
  Electronics manufacturing 681
Purchasing agents 150
Pursers, *see:*
  Merchant marine industry 744
  Merchant officers 299

Quality assurance technicians, *see:* Food processing technicians 396
Quaratine inspectors, foreign 190

Rabbis 555
Rack clerks, hotel 91
Radiation monitors, atomic energy 665
Radiation physicists, atomic energy 665

Radio and television announcers 611
Radio and television broadcasting occupations . 748
Radio officers, *see:*
Merchant marine industry 744
Merchant marine officers 299
Radio operators, ground 293
Radio service technicians 452
Radiographers, *see:*
Aluminum industry 651
Atomic energy 666
Radioisotope-production operators, atomic energy 666
Radiologic (X-ray) technologists 497
Radiological physicists, atomic energy 665
Railroad bridge and building workers 306
Railroad clerks 307
Railroad conductors 307
Railroad industry 752
Railroad occupations 305
Ranchers 621
Range conservationists, *see:* Range managers . 335
Range ecologists, *see:* Range managers 335
Range managers 335
Range scientists, *see:* Range managers 335
Rate clerks, *see:* Trucking industry 759
Real estate agents 232
Real estate salesworkers and brokers 232
Realtors 232
Receipt clerks, merchant marine industry 745
Receiving clerks, *see:*
Baking industry 670
Shipping and receiving clerks 97
Receptionists 96
Record keepers, *see:* Statistical clerks 99
Recording technicians, radio and television ... 387
Recreation workers 566
Reference librarians 213
Refinery mechanics, petroleum refining 723
Refrigeration engineers, *see:* Merchant seamen 302
Refrigeration mechanics 411
Regional geographers 536
Regional planners 604
Registered nurses 501
Registered representatives, *see:* Securities salesworkers 239
Rehabilitation counselors 548
Rehabilitation workers, *see:* Social workers ... 571
Reinforcing-iron workers, building trades 282
Remelt operators, *see:* Aluminum industry 650
Renderers, *see:* Commercial artists 589
Repairmen, *see:*
Aircraft mechanics 287
Automobile body repairmen 415
Central office repairmen, telephone 406
Industrial machinery repairmen 437
Instrument repairmen 438
Jewelry repairmen 440
Locksmiths 442
Shoe repairmen 451
Telephone and PBX repairmen 409
Television and radio service technicians .. 452
Vending machine operators 457
Watch repairmen 459
See also listings under Mechanics and under Servicemen.
Report clerks, merchant marine industry 745
Reporters, newspaper 609
Research and development technicians, *see:*
Food processing technicians 396
Research assistants, lawyers 143
Research dietitians 517
Research directors, advertising 131
Research workers, marketing 144
Reservation agents and clerks, airline 297
Reservation clerks, hotel 91
Reservation control agents 297
Residential carriers, mail carriers 199
Resilient floor layers, *see:* Floor covering installers 262
Respiratory therapists 499
Resistance-welding operators 81
Restaurant industry 764
Retail food stores 767
Retail trade salesworkers 235
Retouchers, photographic laboratory occupations 71
Rewrite men, *see:* Newspaper reporters 609
Rig builders, petroleum and natural gas 635
Riggers and machine movers, building trades .. 282
Riveters, aircraft, missile, and spacecraft 645
Rock-dust machine operators, *see:* Coal mining . 641
Rocket assembly mechanics, aircraft, missile, and spacecraft 645
Rodmen, *see:* Reinforcing-iron workers 282
Rodmen, *see:* Surveyors 399
Roll turners, iron and steel 696
Rollers, iron and steel 695
Rolling mill operators, *see:* Aluminum industry 650
Roman Catholic Priests 556
Roof bolters, *see:* Coal mining 631
Roofers 277
Room and desk clerks, hotel 91
Rotary drillers, petroleum and natural gas 635
Roustabouts, petroleum and natural gas 635

Route salesmen, *see:* Routemen 637
Route salesmen and drivers, laundry and dry-cleaning 784
Route supervisors, baking 671
Routemen 237
See also: Baking industry 670
Rural carriers, mail carriers 199
Rural sociologists, agriculture 625

Safety engineers, *see:* Coal mining 632
Sales clerks, retail trade 235
Sales managers, *see:* Radio and television broadcasting 749
Sales occupations 218
Salesworkers, *see:*
Automobile parts countermen 219
Automobile salesworkers 220
Automobile service advisors 222
Computer salesmen 712
Insurance agents and brokers 226
Manufacturers' salesworkers 230
Real estate saleworkers and brokers 232
Retail trade salesworkers 235
Securities salesworkers 239
Wholesale trade salesworkers 242
Sample makers, apparel 655
Sample-taker operators, petroleum and natural gas 637
Sand mixers, foundries 685
Sandblasters, forge shop 63
Sanitarians 525
Scalemen, *see:* Aluminum industry 650
Scalers, lumber mills 701
Scalper operators, *see:* Aluminum industry 650
Scenic designers, television 748
School counselors 544
School media specialists, *see:* Librarians 213
School social workers 569
School teachers, *see:* Agriculture 625
School teachers, *see:* Teachers 208
Science technicians 391
Scientific and technical occupations 329
Scientists, environmental 352
Scientists, life 365
Scientists, physical 377
Scientists, range 335
Scientists, soil 369
Sealers, electronics manufacturing 681
Seamen; *see:* Merchant seamen 301
Seamstresses, laundry and drycleaning 785
Seat-cover installers, *see:* Automobile trimmers and installation men 54
Second assistant engineers, *see:* Merchant marine officers 299
Second loaders, logging 701
Second mates, *see:* Merchant marine officers 298
Secondary school teachers 206
See also: Home economists 560
Secretaries 102
Securities, salesworkers 239
Seismologists, *see:* Geophysicists 355
Senior typists 105
Separation tenders, *see:* Coal mining 632
Service advisors, *see:* Automobile service advisors 222
Service and miscellaneous 779
Service occupations 153
Service salesmen, *see:* Automobile service advisors 222
Service station attendants, *see:* Gasoline service station attendants 224
Service station mechanic-attendants 224
Service technicians, computer 426
Service writers, *see:* Automobile service advisors 222
Servicemen, *see:*
Appliance servicemen 413
Business machine servicemen 423
Electric sign servicemen 433
Gas appliance servicemen 411
Neon sign servicemen 433
Piano and organ servicemen 448
Telephone and PBX servicemen 409
Television and radio service technicians 452
Setup men (machine tools) 37
Sewage plant operators 79
Sewing machine operators, *see:*
Apparel industry 656
Motor vehicle and equipment manufacturing 707
Shakeout men, *see:* Foundries 685
Shearmen, iron and steel 695
Sheet-metal workers 279
See also:
Aircraft, missile, and spacecraft manufacturing 643
Railroad shop trades 310
Shipping checkers, *see:* Statistical clerks 99
Shipping and receiving clerks 97
Ship's carpenters, *see:* Merchant seamen 302
Ship's electricians, *see:* Merchant seamen 302
Shirt finishers, laundry and drycleaning 785
Shoe repairmen 451
Shooters, petroleum and natural gas 635
Shop trades, railroad 310

Shorthand reporters 103
Shot firers, *see:* Coal mining 631
Shotblasterers, *see:*
Forge shop 63
Foundries 685
Shothole drillers, helpers, petroleum and natural gas 635
Shothole drillers, petroleum and natural gas ... 635
Shuttle car operators, *see:* Coal mining 631
Signal department workers, railroad 311
Signal maintainers, railroad 311
Signalmen, railroad 311
Silk screen printers, electronics manufacturing 681
Singers 583
Skipmen, iron and steel 693
Slaggers, iron and steel 694
Slate roofers, building trades 277
Slicing-and-wrapping machine operators, baking . 670
Slide mounters, *see:* Photographic laboratory occupations 71
Soaking pit cranemen, iron and steel 695
Soaking pit operators, aluminum 650
Social scientists 529
Social secretaries 103
Social service aides 568
Social service occupations 543
Social welfare aides 568
Social workers 570
Sociologists 539
Soil conservationists 337
Soil scientists 369
Sorters, *see:* Bank clerks 114
Sorters, lumber mills 702
Sorters, *see:* Paper and allied products industries 718
Sound effects technicians, radio and television . 749
Space buyers, *see:* Advertising workers 131
Spacecraft manufacturing occupations 643
Special agents, *see:* FBI Special Agents 175
Special librarians 213
Speech pathologists 514
Spotters, laundry and drycleaning 785
Sprayers, motor vehicle and equipment manufacturing 707
Sprinkler fitters, *see:* Plumbers and pipefitters . 275
Staff officers, *see:* Merchant marine officers ... 299
Stage managers, radio and television 748
State and local government occupations 797
State highway patrolmen 187
State police officers 187
Station agents, air traffic 297
Station agents, railroad 312
Station installers, telephone 409
Stationary engineers 75
See also:
Aluminum industry 652
Paper and allied products 718
Stationary firemen (boiler) 77
Statistical assistants 100
Statistical clerks 99
Statisticians 374
See also:
Electronics manufacturing 679
Motor vehicle and equipment manufacturing 706
Office machine and computer manufacturing 712
Steamfitters, *see:* Plumbers and pipefitters 275
Steel industry occupations 692
Steel pourers, iron and steel 694
Stenographers and secretaries 102
Stereotypers, printing, *see:*
Printing occupations 43
Printing and publishing 726
Stewardesses 290
Stewards 290
Stillmen, petroleum refining 722
Stock chasers, motor vehicle and equipment manufacturing 707
Stock clerks 101
See also:
Baking industry 670
Motor vehicle and equipment manufacturing 707
Retail food store 767
Stock house larrymen, iron and steel 693
Stock house men, iron and steel 692
Stonemasons 280
Stove tenders, iron and steel 693
Stratigraphers, *see:* Geologists 353
See also: Petroleum and natural gas production and processing 635
Stretcher-leveler-operators, aluminum industry 651
Strippers, printing 45
Structural-iron workers, building trades 282
Structural-, ornamental-, and reinforcing-iron workers, riggers, and machine movers 282
Student activities personnel, college student personnel workers 135
Student financial aid personnel, college student personnel workers 135
Student housing officers, college student personnel workers 135
Studio supervisors, radio and television 748
Stylists, motor vehicle and equipment manufacturing 704

Substation operators, electric power 739
Supercalendar operators, paper and allied products 718
Surfacers, optical mechanics 431
Surgical technicians 494
Surveyors 399
See also:
Coal mining 632
Petroleum and natural gas production and processing 635
Switchboard operators, electric power 736
Switchers, petroleum and natural gas 636
Switchmen, railroad 305
Switchmen, telephone 405
Synoptic meteorologists 357
Systems analysts 111
See also:
Office machine and computer manufacturing 712
Paper and allied products industry ... 719
Systems operators, electric power 739

Tablet coaters, drug industry 676
Tablet testers, drug industry 676
Tabulating machine operators 93
Tailors, apparel 656
Talleymen, *see:* Statistical clerks 99
Tape librarians, *see:* Computer operating personnel 107
Tape-to-card converter operators, *see:* Computer operating personnel 107
Tappers, *see:* Aluminum industry 649
Taxi drivers 325
Teachers, college and university 208
Teachers, dancing 579
Teachers, high school 206
Teachers, home economists 560
Teachers, kindergarten and elementary school . 204
Teachers, music 581
Teachers, secondary school 206
See also: Home economists 560
Teachers, singing 583
Teachers, vocational, agriculture 625
Teaching occupations 204
Technical illustrators, *see:*
Aircraft, missile, and spacecraft manufacturing 643
Electronics manufacturing 680
Technical secretaries 103
Technical stenographers 103
Technical writers 613
See also: Electronics manufacturing 680
Technician occupations 391
Technicians, broadcasting, radio and television 387
Technicians, dental laboratory 471
Technicians, drug industry 676
Technicians, engineering and science 391
Technicians, food processing 396
Technicians, foundries 685
Technicians, forestry, *see:* Forestry aides and technicians 334
Technicians, medical record 392
Technicians, medical X-ray 497
Technicians, television and radio service 452
Telegraphers, telephoners, and towermen, railroad 313
Telephone crafts occupation 405
Telephone industry 755
Telephone installers 409
Telephone linemen and cable splicers 406
Telephone operators 200
Telephone repairmen 409
Telephone servicemen 409
Telephoners, railroad 313
Teletypists 293
Television and radic service technicians 452
Television announcers 611
Television broadcasting occupations 748
Tellers, banking 117
Terrazzo workers, building trades 266
Testboardmen, telephone 405
Testing technicians, paper and allied products . 719
Therapeutic dietitians 517
Therapists, inhalation 499
Therapists, occupations 508
Therapists, physical 511
Therapy and rehabilitation occupations 508
Therapy assistants, occupational 510
Third assistant engineers, *see:* Merchant marine officers 299
Third mates, *see:* Merchant marine officers ... 298
Thread trimmers and cleaners, apparel 656
Ticket agents, airline 297
Ticket sellers, *see:* Cashiers 88
Tile roofers, building trades 277
Tilesetters, building trades 266
Timber cruisers, logging 701
Time buyers, *see:* Advertising workers 131
Time salesmen, radio and television 749
Tinners, electronics manufacturing 681
Tobacco farmers 623
Tool-and-die makers 38
See also:
Aircraft, missile, and spacecraft manufacturing 645
Electronics manufacturing 681

Office machine and computer manufacturing 713
Tool designers, *see:* Mechanical technicians ... 393
Tool pushers, *see:* Office machine and computer manufacturing 713
Toolmakers, electronics manufacturing 681
Towermen, railroad 313
Toxicologists, drug industry 676
Tracers, *see:* Draftsmen 390
Tractor operators, *see:* Coal mining 631
Track workers, railroad 313
Trackmen, railroad 313
Traffic agents and clerks, airline 297
Traffic controllers, air-route 286
Traffic controllers, airport 286
Traffic managers, industrial 140
Traffic managers, radio and television 748
Traffic representatives, airline 297
Trainmen, *see:* Brakemen, railroad 305
Transcribing machine operators, *see:* Typists .. 105
Transit clerks, *see:* Bank clerks 115
Transmission and distribution occupations, electric power 739
Transmitter technicians, radio and television .. 387
Transportation activities 285
Transportation, communication, and public utilities 729
Treaters, *see:*
Petroleum and natural gas 636
Petroleum refining 723
Treatment plant operators, wastewater 79
Trimmer saw operators, lumber mills 756
Trimmers, forge shop 63
Trimmers, hand, apparel 656
Troopers, *see:* State police officers 187
Troublemen, electric power 739
Truck mechanic helpers, *see:* Trucking industry 759
Truck mechanics 454
See also: Trucking industry 759
Truckdriver helpers 759
Truckdrivers, *see:*
Baking industry 671
Drug industry 676
Electronics manufacturing 681
Foundries 685
Office machine and computer manufacturing 714
Trucking 759
Truckdrivers, local 319
Truckdrivers, long-distance 321
Trucking industry 758
Tube benders, aircraft, missile, and spacecraft . 645
Tumbler operators, foundries 685
Tune-up men, *see:* Automobile mechanics 417
Turbine operators, electric power 736
Type inspectors, office machine and computer manufacturing 713
Typesetters, hard, printing, *see:*
Composing room occupations 40
Printing and publishing 726
Typesetting machine operators, printing 40
Typists 105

Underwriters, insurance 125
See also: Insurance industry 776
University librarians 213
University teachers 208
Upholsterers, *see:*
Automobile trimmers and installation men 53
Furniture upholsterers 64
Upsetters, forge shop 63
Urban geographers 536
Urban planners 604
Utilitymen, *see:*
Merchant marine industry 744
Merchant seamen 302
Valets, *see:* Private household workers 176
Varitypists 105
Vending machine mechanics 457
Vending machine routemen, *see:* Routemen ... 237
Veterinarians 483
See also:
Agriculture 624
Life scientists 366
Video-control technicians, television 387
Video recording technicians, television 387
Virologists, *see:* Drug industry 676
Vocational agriculture teachers, *see:* Agriculture 625
Vocational counselors, *see:* Employment counselors 546
Vocational nurses, licensed 504
Volcanologists, *see:* Geologists 352

Wage-hour compliance officers 192
Waiters and waitresses 167
Wash box attendants, *see:* Coal mining 632
Washers, *see:* Trucking industry 759
Washmen, laundry and drycleaners 784
Waste disposal men, atomic energy 666
Waste treatment engineers and technicians, *see:* Petroleum refining 666
Waste-treatment operators, atomic energy 723
Wastewater treatment plant operators 79
Watch engineers, electric power 737
Watch repairmen 459

Watchmakers 459
Watchmen 183
Waterproof workers, *see:* Roofers 277
Waybill clerks, *see:* Typists 105
Welders, gas 81
Welders, petroleum and natural gas 636
Welders and flame cutters 81
See also:
Aircraft, missile, and spacecraft manufacturing 645
Electronics manufacturing 681
Natural gas processing 636
Welding operators, resistance 81
Well pullers, petroleum and natural gas 637
Wheat farmers 622
Wholesale and retail trade 763
Wholesale trade salesworkers 641
Window clerks, postal clerks 94
Wipers, *see:*
Merchant marine industry 744
Merchant seamen 302
Wire draw operators, aluminum 651
Wire drawers, iron and steel 695
Wood patternmakers, foundry occupations ... 26
Working housekeepers, *see:* Private household workers 177
Writers, technical 613

X-ray technicians, medical 497

Yard brakemen, railroad 305
Yarder engineers, logging 701
Young adult services librarian 213

Zoologists, *see:*
Drug industry 675
Life scientists 366

Dictionary of Occupational Titles (D.O.T.) Index

D.O.T. No.		Page
001.081	Architect	586
	Architect, marine	745
001.281	Draftsman, architectural	389
002.	Aeronautical engineering occupations	391
002.081	Aeronautical engineer	342
002.281	Draftsman, aeronautical	389
003.	Electrical engineering occupations	391
003.081	Electrical engineer	346
003.151	Industrial-power engineer	346
003.187	Electrical engineer, power	346
	Systems engineer	111
003.281	Draftsman, electrical	389
	Draftsman, electronic	389
	Estimator and draftsman	389
005.	Civil engineering occupations	391
005.081	Civil engineer	345
005.281	Draftsman, civil	389
	Draftsman, structural	389
006.	Ceramic engineering occupations	391
006.081	Ceramic engineer	344
007.	Mechanical engineering occupations	391
007.081	Air-conditioning engineer	676
	Mechanical engineer	348, 676
	Refrigeration engineer	676
007.151	Heating engineer	348, 676
007.168	Chief engineer	348
007.181	Mechanical-engineering technician	348, 676
	Engineering assistant mechanical equipment	676
007.187	Plant engineer	348, 676
007.281	Draftsman, mechanical	389
	Lay-out man and checker	389
008.	Chemical engineering occupations	391
008.081	Chemical engineer	345, 676
010.	Mining and petroleum engineering occupations	391
010.081	Mining engineer	350, 632
010.168	Observer	635
010.187	Mining investigator	350, 632
010.281	Draftsman, geological	389
	Draftsman, mine	389, 635
010.288	Prospecting computer	635
011.	Metallurgy and metallurgical engineering occupations	391
011.081	Foundry metallurgist	348
	Metallurgist, extractive	349
012.	Industrial engineering occupations	391
012.081	Safety engineer	347, 676
012.168	Director, quality control	676
	Methods engineer, chief	347, 676
	Systems analyst, business electronic data processing	111
012.187	Manufacturing engineer	676
012.188	Efficiency engineer	676
	Factory-lay-out man	676
	Fire-protection engineer	676
	Industrial engineer	347, 676
	Industrial-health engineer	676
	Production engineer	676
	Production planner	644, 676
	Quality-control engineer	676
	Time study engineer	676
012.281	Air analyst	676
013.	Agricultural engineering occupations	391
013.081	Agricultural engineer	343, 624
014.	Marine engineering occupations	391
014.281	Draftsman, marine	389
015.	Nuclear engineering occupations	389, 391
017.	Draftsmen and related work	389, 391
017.281	Technical illustrator	644
018.	Surveying and related work	391
018.188	Surveyor	399, 632, 635
019.	Architecture and engineering, n.e.c.	391
019.081	Landscape architect	599
019.187	Drainage-design coordinator	348
019.281	Quality-control technician	726
020.	Occupations in mathematics	391
020.081	Applications engineer	111
020.088	Mathematician	371
	Statistician, mathematical	111
020.188	Actuary	119,776
	Programmer, business	109
	Programmer, engineering and scientific	109
	Statistician, applied	374
021.	Occupations in astronomy	391
021.088	Astronomer	377
022.	Occupations in chemistry	391
022.081	Chemist, analytical	379, 381, 675
	Chemist, food	379, 381
	Chemist, inorganic	379, 381, 675
	Chemist, organic	379, 381, 675
022.168	Chemical-laboratory chief	379
022.181	Perfumer	379
022.281	Chemist, water purification	379

D.O.T. No.		Page
	Malt-specification-control assistant	396
023.	Occupations in physics	391
023.081	Physicist	383
	Physicist, light	383
023.088	Physicist, theoretical	383
024.	Occupations in geology	391
024.081	Geologist	352, 635
	Geophysicist	354, 635
	Minerologist	635
	Oceanographer	359
	Paleontologist	635
	Petrologist	635
	Photogeologist	635
	Stratigrapher	635
025.	Occupations in meteorology	391
025.088	Meteorologist	357
029.	Occupations in mathematics and physical sciences, n.e.c.	391
029.088	Geographer	535
029.381	Bottle-house quality-control technician	396
	Laboratory tester	396
040.	Occupations in agricultural sciences	365
040.081	Agronomist	624
	Animal husbandman	624
	Food technologist	381
	Forester	332, 625, 701
	Range manager	335
	Soil conservationist	337
	Soil scientist	369
041.081	Anatomist	365
	Biochemist	363, 381, 675
	Biologist	675
	Botanist	675
	Entomologist	[illegible]
	Geneticist	625
	Microbiologist	625, 675
	Oceanographer	359
	Pharmacologist	675
	Physiologist	675
	Plant quarantine and plant pest control inspector	625
	Plant scientist	625
041.168	Fish culturist	365
041.181	Histopathologist	365, 675
041.281	Public-health bacteriologist	365
045.088	Psychologist, developmental	563
	Psychologist, educational	563
	Psychologist, engineering	563
	Psychologist, experimental	563
	Psychologist, social	563
045.108	Counselor	134, 546
	Director of guidance	548
	Psychologist, clinical	563
	Psychologist, counseling	563
	Psychologist, school	544
	Residence counselor	134
050.088	Economist	532, 624
	Market research analyst	130, 144

D.O.T. No.		Page
051.088	Political scientist	538
052.088	Historian	534
054.088	Sociologist	539, 625
055.088	Anthropologist	529
059.088	Economic geographer	535
070.101	Surgeon	478
070.108	General practitioner	478
071.108	Osteopathic physician	476
072.108	Dentist	465
073.081	Veterinarian laboratory animal care	483, 624
073.108	Veterinarian	483
073.181	Veterinary livestock-inspector	483
073.281	Veterinary virus-serum inspector	483
073.381	Laboratory technician, veterinary	676
074.181	Pharmacist	523
075.	Registered nurses	501
077.081	Research nutritionist	517
077.128	Dietitian, teaching	517
	Dietitian, therapeutic	517
	Nutritionist	517, 625
077.168	Dietitian	517
	Dietitian, administrative	517
078.128	Medical technologist, teaching supervisor	489, 676
078.168	Medical technologist, chief	489, 497, 676
	Radiologic technologist, chief	489, 497
078.281	Biochemistry technologist	676
	Medical technologist	489
	Microbiology technologist	676
078.381	Medical-laboratory assistant	489, 676
	Tissue technologist	676
078.368	Dental hygienist	469
	Electrocardiograph technician	485
	Electroencephalograph technician	486
	Radiologic technologist	497
078.687	Laboratory assistant, plasma drawing-off	676
079.108	Audiologist	514
	Chiropractor	473
	Optometrist	475
	Podiatrist	481
	Speech pathologist	514
079.118	Sanitarian	525
079.128	Occupational therapist	508
	Recreational therapist	566
079.368	Corrective therapist	511
	Inhalation therapist	499
	Medical assistant	488
	Occupational therapist aid	510
079.378	Dental assistant	467
	Nurse, licensed practical	504
	Surgical technician	494
090.118	Dean of students	134
	Financial-aids officer	134
090.168	Department head, college or university	208
	Director of admissions	134
	Director of student affairs	134
	Director of summer sessions	134

D.O.T. No.		Page
	Discipline counselor	134
	Registrar, college or university	208
090.228	Faculty member, college or university	208
090.999	Graduate assistant	208
091.228	Teacher, agriculture	625
	Teacher, secondary school	206
092.228	Teacher, elementary school	204
	Teacher, kindergarten	204
096.128	Extension service specialist	559
	Home economist	560
	Home economist, consumer service	560
099.228	Governess	176
100.	Librarians	212
100.388	Medical-record librarian	521
110.108	Lawyer	141
110.118	Lawyer, admiralty	141
	Lawyer, corporation	141
	Lawyer, criminal	141
	Lawyer, patent	141
	Lawyer, probate	141
	Lawyer, real estate	141
119.168	Title supervisor	141
120.108	Clergyman	553, 555, 556
129.108	Director of religious activities	134
132.088	Copy writer	130
132.268	Reporter	609
132.388	Editor, index	90
137.268	Interpreter	606
139.288	Technical writer	613
141.031	Director, art	589
141.081	Advertising lay-out man	130
	Art lay-out man	589
	Cartoonist, motion pictures	589
	Color advisor	589
	Cover designer	589
	Illustrator	589
	Lay-out man	589
	Medical illustrator	589
	Miniature-set constructor	589
	Stipple artist	589
141.168	Production manager, advertising	130
142.051	Interior designer and decorator	597
142.081	Designer	654
	Floral designer	593
	Industrial designer	595
143.062	Photographer apprentice, commercial	602
	Photographer apprentice, portrait	602
	Photographer, commercial	602
	Photographer, news	602
	Photographer, portrait	602
143.282	Photographer, scientific	602
143.382	Biological photographer	602
	Photographer, aerial	602
150.028	Dramatic coach	576
	Teacher, drama	576
150.048	Actor	576
151.028	Instructor, dancing	478
151.048	Dancer	478
152.028	Teacher, music	581, 583
	Concert singer	583
152.048	Musical entertainer	583
	Musician, instrumental	583
	Orchestra leader	581
	Popular singer	583
159.148	Announcer	611
	Announcer, international broadcast	611
	Disc jockey	611
	Sports announcer	611
159.228	Counselor, camp	566
160.188	Accountant	128
161.118	Treasurer	116
162.158	Purchasing agent	130, 150
163.118	Hotel manager	139
164.	Advertising management occupations	130
165.068	Public-relations man	147
166.	Personnel and training administration occupations	146
166.168	Director of placement	134
166.268	Placement officer	550
168.168	Building inspector	195
	Customs inspector	189
	Health officer, field	189
	Immigration inspector	189
	Manager, credit and collection	137
168.268	Operations inspector	189
	Safety-and-sanitary inspector	189
168.287	Check viewer	189
	Food and drug inspector	189
	Inspector, weights and measures	189
	Plant-quarantine inspector	189
	Poultry grader	189
	Sanitary inspector	189
168.288	Claim examiner	123
169.188	Underwriter	125, 776
180.188	Field man	150
182.168	Track worker	313
182.287	Construction inspector	195
184.168	Manager, traffic	140
186.118	Manager, financial institution	116
186.138	Manager, safe deposits	116
186.168	Operations officer	116
186.288	Loan officer	116, 137
187.118	Manager, hotel	139
	Scout, professional sports	566
	Superintendent, institution	519
	Superintendent, recreation	566
187.168	Director, funeral	173
	Manager, front office	139
	Superintendent, building	139, 155
188.118	Manager, city	132
189.118	President	116
189.168	Junior executive	116
191.118	Leaseman	150, 635
	Right-of-way agent	150
191.268	Claim adjuster	121

D.O.T. No.		Page
193.168	Air-traffic controller	286
193.282	Ground radio operator	293
	Radio officer	299, 744
194.281	Sound-effects man	387
194.282	Sound man	387
	Sound mixer	387
194.782	Recording-machine operator	387
195.108	Caseworker	570
	Community-relations and services advisor, public housing	570
	Group worker	570
	Social group worker	570
	Social worker, delinquency prevention	570
195.118	Administrator, social welfare	570
	Director, welfare	570
195.168	Casework supervisor	570
	Director, camp	566
	Director, recreation center	566
195.208	Case aid	570
195.228	Program aid, group work	570
	Program leader	566
196.168	Chief pilot	294
196.228	Instructor, pilot	294
196.268	Check pilot	294
196.283	Airplane pilot	294
197.130	Chief engineer	298
	First assistant engineer	298
	Second assistant engineer	299
	Third assistant engineer	299
197.133	Chief mate	298
	Deck officer	743
197.136	Marine engineer	744
	Second mate	298
	Third mate	298
197.168	Captain	298, 743
	Master	298, 743
	Purser	299, 744
198.168	Conductor	307
199.168	Urban planner	604
199.381	Radiographer	651
201.268	Social secretary	103
201.368	Secretary	103
202.388	Court reporter	102
	Stenographer	102
203.	Typists	105
203.582	Varitypists	105
203.588	Mortgage clerk	105
	Policy writer	105
	Telegraphic-typewriter operator	293
205.368	Personnel clerk	90, 99
206.388	File clerk I	90
	File clerk II (classification clerk)	90
206.588	Record keeper	99
207.782	Duplicating machine operator II and III	93
207.884	Duplicating machine operator I	93
207.885	Duplicating machine operator IV	93
208.588	Transcribing-machine operator	105, 726
208.782	Embossing-machine operator	93

D.O.T. No.		Page
209.138	Stenographic-pool supervisor	102
209.382	Justowriter operator	105
209.388	Clerk-typist	105
	Mortgage clerk	115
209.488	Circulation clerk	105
209.584	Morticer	105
209.587	Sampleman, paper	105
209.588	Car checker	99
	Waybill clerk	105
209.688	Checker II	97, 726
210.368	Account-information clerk	87
210.388	Bookkeeper (clerical) I	87
	Bookkeeper (clerical) II	115
210.488	Dividend-deposit-voucher quoter	87
210.588	Insurance clerk	87
211.	Cashiers	88
211.468	Station agent II	312
212.368	Teller	117
213.138	Supervisor, computer operations	107
	Supervisor, machine-records unit	107
213.382	Card-to-tape converter operator	107
	Console operator	107
	High-speed printer operator	107
	Tape-to-card converter operator	107
213.582	Key-punch operator	107
213.588	Data typist	107
213.782	Tabulating-machine operator	93
213.885	Sorting-machine operator	107
214.488	Billing-machine operator	92
215.388	Bookkeeping-machine operator I	92, 114
216.388	Bookkeeping-machine operator II	87
216.488	Adding-machine operator	93
	Calculating-machine operator	93
217.388	Proof-machine operator	114
	Transit clerk	115
219.388	Actuarial clerk	100
	Billing clerk	87, 97, 745
	Checker	87
	Coding clerk	99
	County-collection clerk	115
	Crew scheduler	100
	Demurrage clerk	100
	Exchange clerk	115
	Interest clerk	115
	Manifest clerk	745
	Rate clerk	759
	Sorter	114
	Statistical clerk	100
219.488	Accounting clerk	87, 99, 115
	Insurance clerk	100
219.588	Kardex clerk	90
	Posting clerk	99
222.138	Shipping clerk	97
222.368	Expediter	97
222.387	Freight-receiving clerk	97
222.388	Container coordinator	97
222.478	Retail-receiving clerk	97
222.488	Manifest clerk	759
	Receipt clerk	97
222.587	Shipping clerk	97

D.O.T. No.		Page
222.588	Traffic clerk	97
222.687	Shipping checker	97, 99
223.138	Supervisor, stock	101
223.368	Procurement clerk	101
223.387	Checker	101
	Linen-room attendant	101
	Magazine keeper	101
	Material clerk	101
	Parts clerk	101, 759
	Stock clerk	97
	Storekeeper	101
	Tape librarian	107
	Tool clerk	101
223.388	Inventory clerk	101
223.588	Swatch clerk	101
	Talleyman	101
223.687	Checker I	101
231.688	Distribution clerk	94
232.138	Foreman, mails	94
232.368	Post-office clerk	94
233.138	Foreman, carriers	199
233.388	Mail carrier	199
234.582	Mail preparing and mail handling	93
234.885	Mail preparing and mail handling	93
235.862	Information operator	96
	Telephone operator	200
236.588	Telegrapher and telephoner	313
237.368	Receptionist	96
239.588	Meter reader	741
	Router	97
241.168	Claim adjuster	121,775
241.368	Claims clerk	758
242.368	Front office clerk	91
249.268	Claim examiner	123, 775
249.368	Library assistant	215
249.388	Medical record clerk	492
250.258	Life underwriter	226
	Salesman, insurance	776
250.358	Salesman, real estate	232
251.258	Salesman, securities	239
252.358	Leaseman	150
26 27 28	Salesmen and salespersons, commodities	230, 235, 241
266.158	Pharmaceutical detail man	676
280.358	Salesman, automobile	220
289.358	Salesperson, parts	219
290.	Sales checkers	235
292.358	Driver salesman	670
	Routeman	238, 784
292.887	Salesman-driver helper	237
297.868	Model	228
298.081	Display man	591
299.468	Cashier-checker	88
299.884	Optician, dispensing	431
301.887	Day worker	176
303.138	Housekeeper, home	176
303.878	Farm housekeeper	176
	Farm housemaid	176
304.887	Man-of-all-work	176
	Yardman	176
305.281	Cook	176
306.878	Maid, general	176
	Mother's helper	176
307.878	Nursemaid	176
309.	Domestic service occupations, n.e.c.	176
309.138	Butler	176
309.878	Companion	176
	Personal maid	176
	Valet	176
309.999	Domestic couple	176
311.	Waiters, waitresses, and related food servicing occupations	166
312.878	Bar attendant	161
	Bartender	161
313.	Chefs and cooks, large hotels and restaurants	163
314.	Chefs and cooks, small hotels and restaurants	163
315.	Miscellaneous cooks, except domestic	163, 302, 744
316.	Meatcutters, except in slaughtering and packing houses	165
318.887	Utility man	302
321.138	Housekeeper	159
	Inspectress	159
324.	Bellmen and related occupations	170
330.371	Barber	169
	Barber apprentice	169
331.878	Manicurist	171
332.271	Cosmetologist	171
332.381	Wig dresser	171
338.381	Embalmer	173
339.371	Electrologist	171
	Scalp-treatment operator	171
350.138	Chief steward	302, 744
350.878	Messman	302, 744
352.878	Stewardess	290
355.687	Clothes-room worker	505
355.878	Attendant, physical therapy	512
	Emergency-entrance attendant	505
	Hospital guide	505
	Nurse aid	505
	Orderly	505
	Psychiatric aid	505
	Tray-line worker	505
355.887	Morgue man	505
356.381	Horseshoer	55
361.885	Washman	784
362.381	Spotter	785
362.782	Drycleaner	785
363.782	Presser, machine	313, 656, 785
363.884	Presser, hand	656
363.885	Presser, form	656
363.886	Flat work finisher	785
365.381	Shoe repairman	451
369.687	Assembler	785
	Inspector	785
369.887	Counter clerk	784

D.O.T. No.		Page
	Marker	784
372.868	Guard	183
	Watchman	183
373.	Firemen, fire department	181
375.118	Police Chief	185, 187
375.138	Desk officer	185
	Desk officer, chief	187
	Secretary of police	187
375.168	Commanding officer, harbor-police	185
	Commanding officer, homicide squad	185
	Commanding officer, investigation division	185
	Commanding officer, motorcycle squad	185
	Commanding officer, motor equipment	185
	Detective chief	185
	Harbor master	185
	Matron, head	185
	Pilot, highway patrol	187
	Police captain, precinct	185
	Police lieutenant, precinct	185
	Police sergeant, precinct	185
	Special agent, FBI	179
	Traffic lieutenant	185
	Traffic sergeant	185
375.228	Police-academy instructor	185, 187
375.268	Detective	185, 187
375.388	Fingerprint classifier	185, 187
375.588	Parking enforcement officer	185
375.868	Border patrolman	185
	Matron	185
377.868	Bailiff	185
	Sheriff, deputy	185
381.137	Charwoman, head	155
	Porter, head	155
381.887	Charwoman	155
	Cleaner, laboratory equipment	155
	Porter I	155
	Porter II	155
382.	Janitors	155
389.781	Termite treater	156
389.884	Exterminator	156
441.137	Suppression-crew leader	334
441.168	Fire lookout	334
	Fire warden	334
441.384	Forestry aid	334
441.687	Fire patrolman	334
441.887	Forest-fire fighter	334
	Sprayer	334
	Tree pruner	334
	Tree planter	334
449.287	Cruiser	701
500.380	Plater	58, 645
	Plater, apprentice	58
500.782	Plater, barrel	58
500.884	Matrix-plater	58
500.885	Plater, production	58, 707
500.886	Laborer, electroplating	58
501.782	Anodizer	681
501.885	Plater, hot dip	681
502.884	Blast furnace keeper	694
	Second helper	694
502.887	Scaleman	650
503.885	Pickler	63
503.887	Sandblaster and shotblaster	63, 525
504.782	Heat treater	63, 645, 651, 685
512.132	Melter foreman	694
512.782	First helper	694
	Furnace operator	685
	Oxygen furnace operator	694
	Stove tender	693
512.885	Potman	649
	Remelt operator	650
514.687	Casting inspector	685
514.782	Casting operator	650
514.884	Pourer, metal	685, 694
	Tapper	649
514.887	Tapper, helper	649
518.381	Coremaker	29
	Floor coremaker	29, 685
	Hand molder	685
518.782	Machine molder	28, 685
518.884	Coresetter	685
	Pourer	685
518.885	Coremaker, machine	29
	Core-oven tender	685
518.887	Core assembler	685
519.132	Foreman, blast furnace	693
519.884	Pot liner	649
519.887	Foundry worker, general	685, 694
	Molder, helper	685, 694
	Third helper	694
520.884	Bench hand	669
520.885	Batter mixer	669
	Blender	669
	Dividing-machine operator	669
	Dough-brake-machine operator	669
	Icing mixer	670
	Mixer	669
	Molding machine operator	669
	Pretzel-twisting-machine operator	669
	Sweet-goods-machine operator	669
521.885	Slicing-and-wrapping machine operator	670
524.884	Hand icer	670
525.885	Machine icer	670
526.781	All-round baker	670
526.782	Dividerman	669
526.885	Ovenman	669
526.886	All-round baker helper	670
530.782	Beater engineer	717
532.782	Digester operator	717
532.885	Backtender	717
533.782	Barker operator	701, 716
	Power-barker operator	701
534.782	Supercalendar operator	718
539.782	Paper machine operator	717

D.O.T. No.		Page
541.782	Coal washer	631
	Crude oil treater	636
542.280	Stillman	722
542.782	Pumper	723
	Pumpman	723
549.138	Preparation plant foreman	631
549.782	Pumpman	723
	Treater	723
549.884	Pumpman	723
550.885	Compounder	676
554.782	Pill and tablet coater	676
556.782	Compressor	676
558.885	Chemical operator	688
559.687	Ampoule examiner	676
	Tablet tester	676
559.782	Chemical operator	688
	Granulator machine operator	676
	Pharmaceutical operator	676
559.885	Ampoule filler	676
563.381	Kiln operator	702
579.782	Sand mixer	685
590.885	Etcher, printed circuits	681
	Firer	681
599.885	Tumbler operator	685
600.280	Instrument maker	33
	Machinist	31, 310, 645
	Maintenance machinist	645
	Metal patternmaker	26, 685
600.281	Machine builder	31, 645
600.380	Job setter	37
600.381	Lay-out man	31
601.280	Die sinker	63
	Tool-and-die maker	38, 63, 645
601.281	Die maker, bench	38
	Tool maker, bench	38
601.381	Plastic tool maker	38
602.	Gear machining occupations	35
603.	Abrading occupations	35
604.	Turning occupations	35
605.	Milling and planing occupations	35
605.782	Scalper operator	650
606.	Boring occupations	35
609.381	Inspector, floor	646, 713
609.885	Production-machine operator	645
610.381	Blacksmith	55, 310
610.782	Drop-hammer operator	62
611.782	Forging- press operator	62
	Upsetter	63
611.885	Press operator	62
612.281	Inspector	63
612.381	Hammersmith	62
613.780	Roll-tube setter	696
613.782	Heater	695
	Manipulator operator	695
	Roller	695
	Rolling mill operator	650
	Soaking pit operator	650
613.885	Coiler operator	651
	Piercer-machine operator	603
614.782	Extrusion press operator	651
	Wire drawer	651, 695
615.782	Power shear operator	644
	Punch press operator	644
	Shearman	695
615.885	Power shear operator	644
617.782	Power hammer operator	644
617.885	Trimmer	63
	Punch-press operator	681
619.782	Heater	63
	Stretcher-leveler-operator	651
619.886	Stretcher-leveler-operator helper	651
620.131	Automobile mechanic, chief	417
620.138	Automobile-test-shop	417
620.281	Automobile mechanic	417
	Automobile-repair-service salesman	222
	Motorcycle repairman	446
	Truck mechanic	454, 759
620.381	Automobile-service mechanic	417
620.384	Motorcycle-tester	446
620.782	Brake-drum-lathe-operator	417
620.884	Truck mechanic helper	759
620.885	Bonder, automobile brakes	417
621.281	Aircraft mechanic	287
	Flight engineer	292
622.381	Carman	310
623.281	Motorboat mechanic	420
623.381	Gear man	101
624.281	Farm-equipment mechanic	435
625.281	Diesel mechanic	428
	Missile assembly mechanic	645
	Outboard motor tester	420
	Rocket assembly mechanic	645
626.	Metalworking machinery mechanics	437
627.	Printing and publishing mechanics and repairmen	437
628.	Textile machinery and equipment mechanics and repairmen	437
629.	Special industry machinery mechanics	437
630.	General industry mechanics and repairmen	437
630.381	Conveyor-maintenance man	631
630.884	Anode man	649
631.	Powerplant mechanics and repairmen	437
633.281	Assembly technician	423
	Cash register serviceman	423
	Dictating-transcribing-machine serviceman	423
	Machine analyst	423
	Mail-processing-equipment mechanic	423
	Office-machine serviceman	423
	Office-machine-serviceman, apprentice	423
	Statistical-machine serviceman	423
637.281	Air-conditioning and refrigeration mechanic	411, 413

D.O.T. No.		Page
	Gas burner mechanic	411, 413
637.381	Air-conditioning and refrigeration mechanic	411
638.281	Millwright	67
639.381	Pinsetter adjuster, automatic	422
	Vending machine repairman	457
641.885	Envelope machine operator	718
649.687	Paper sorter and counter	718
650.582	Linotype (or intertype) machine operator	41
	Monotype keyboard operator	41
	Phototypesetting machine operator	42
651.782	Lithographic pressman	45
	Printing-press operator	48, 726
	Printer-slotter operator	718
651.885	Offset press operator II	48, 726
651.886	Cylinder-press feeder	48, 726
654.782	Monotype caster operator	42
661.281	Wood patternmaker	26
665.782	Timber-sizer operator	702
667.782	Cut-off-saw operator	701
	Edger man	701
	Head-saw operator	701
667.885	Block setter	701
667.887	Deckman	701
669.587	Grader	702
674.782	Glass lathe operator	681
668.885	Chipperman	716
692.782	Sealing machine operator	713
692.885	Sealing machine operator	681
693.280	Form builder	645
699.887	Wiper	302, 744
700.281	Brooch maker	440
	Jeweler	440
700.381	Chain maker	440
	Fancy-wire drawer	440
	Goldbeater	440
	Lay-out man	440
	Locket maker	440
	Mold maker	440
	Ring maker	440
	Stone setter	440
705.884	Grinder	63
	Metal finisher	707
	Polisher	707
706.687	Type inspector	707, 713
706.884	Assembler	713
709.281	Locksmith	442
	Locksmith apprentice	442
709.884	Tube bender	645
710.131	Instrument-repairman foreman	438
710.281	Instrument-repairmen I	438
712.381	Dental-laboratory technician	471
713.251	Optician, dispensing	431
713.381	Optician	431
	Optician apprentice	431
713.884	Assembler, gold frame	431
	Assembler, molded frames	431
	Contact-lens-curve grinder	431
	Contact-lens-edge buffer	431
	Contact-lens-polisher	431
	Countersink grinder	431
	Embosser and trimmer	431
	Eyeglass-lens cutter	431
	Frame carver, spindle	431
	Groover	431
	Heating-fixture tender	431
	Lens assembler	431
	Lens blank marker	431
	Lens generator	431
	Mounter and repairer	431
	Plastic-frame insert man	431
	Polisher	431
	Spectacles truer	431
	Trim mounter	431
715.281	Repairman	459
720.281	Radio repairman	452
	Television service and repairman	452
720.884	Aliner	680
	Cabinet mounter	680
721.281	Electric-motor analyst	417
	Electric-motor assembler and tester	417
	Electric-motor repairman	417
	Propulsion-motor-and-generator-repairman	417
721.381	Electric-motor fitter	310
722.281	Inspector, systems	681, 713
723.381	Electrical appliance repairman	413
724.781	Coil winder	681
724.884	Coil winder, hand	681
725.884	Exhaust lathe operator	681
	Grid lathe operator	681
726.384	Inspector, subassemblies	713
726.781	Electronics assembler	680, 713
726.884	Cable maker	680
	Capacitor assembler	680, 713
	Capacitor winder	680
	Condenser aliner	680
	Crystal finisher	680, 681
	Crystal lapper	680
726.887	Silk-screen printer	681
729.281	Electrical-instrument repairman	437
	Meter tester	741
	Meterman	741
729.381	Production repairman	681
729.884	Chassis assembler	680
730.281	Piano technician	449
730.381	Pipe-organ technician	448
741.887	Sprayer	707
780.381	Automobile upholsterer	53
	Furniture upholsterer	64
780.884	Automobile-seat-cover-and-convertible-top-installer	54
	Cushion builder	707
	Stuffing machine operator	707
781.381	Pattern grader	655
	Patternmaker	655
781.484	Marker	655
781.687	Assembler	655

D.O.T. No.		Page
	Bundler or fitter	655
781.884	Cutter	655, 707
	Machine spreader	655
781.887	Hand spreader	655
	Trimmer, hand	656
782.884	Hand sewer	656
	Seamstress	784
783.381	Fur finisher	657
783.781	Fur cutter	656
783.884	Fur nailer	657
785.261	Tailor	656
785.281	Bushelman	656
785.361	Dressmaker	656
785.381	Sample stitcher	655
	Tailor	656
787.782	Fur machine operator	657
	Sewing machine operator	656, 707
789.687	Inspector or checker	656
800.884	Riveter	645
801.281	Fitter I	282, 631
801.381	Armament assembler	646
	Fitter	282
801.781	Structural-steel-worker	282
	Structural-steel-worker apprentice	282
801.884	Reinforcing ironworker	282
804.281	Sheet-metal worker	277, 279, 310, 644
804.884	Assembler, unit	279
805.281	Boilermaker	57, 310
806.281	Dynamometer tester, motor	707
806.283	Test driver	707
806.381	Final inspector, truck trailer	707
	Inspector, assemblies and installations	646
806.382	Hypoid-gear tester	707
806.387	Inspector, returned materials	707
806.684	Transmission tester	707
806.687	Final inspector	707
806.781	Final assembler	645
806.887	Assembler	706
807.381	Automobile body repairman	415
	Fabrication inspector	646
809.381	Layout man I	56
	Ornamental-ironworker	282
	Structural-ironworker	282
809.781	Lay-out man II	56, 282
809.884	Assembler, production line	282
	Grinder-chipper	685
809.887	Laborer, steel handling	256
	Ornamental-iron-worker helper	256
810.	Arc welders	81
810.782	Welder	645
810.884	Welder	645
811.	Gas welders	81
811.782	Welder	645
811.884	Welder, gas	645
812.	Combination arc welders and gas welders	81
812.884	Welder, production line	645
813.	Resistance welders	81, 645
814.	Brazing, braze-welding, and soldering occupations	81
815.	Lead-burning occupations	81
816.	Flame cutters and arc cutters	81
819.	Welders, flame cutters, and related occupations, n.e.c.	81
819.781	Fit-up man	57
821.281	Troubleman	739
821.381	Cable man	258
	Lineman	739
	Meter installer I	741
821.887	Groundman	740
822.281	Central office repairman	405
	PBX repairman	410
	Signal department worker	311
	Telephone repairman	409
	Testboardman	405
822.381	Lineman	407
	PBX installer	409
	Telephone installer	409
822.884	Frameman	405
	Signal department worker	311
823.281	Meteorological-equipment repairer	437
824.281	Electrician	258
	Neon-sign serviceman	433
825.281	Electrician	302, 444, 744
	Electrician, automotive	417
825.381	Elevator constructor	260
827.281	Electrical-appliance serviceman	413
828.281	Data-processing equipment serviceman	426
	Radioactivity-instrument- maintenance technician	438
829.281	Electrical repairman	258, 444
	Elevator repairman and apprentice	260
	Pinsetter mechanic, automatic	422
829.381	Cable splicer	258, 408, 740
	Electronic organ technician	449
840.381	Painter, stage settings	271
840.781	Painter	271
840.884	Painter, rough	271
841.781	Paperhanger	271
842.381	Stucco mason	273
842.781	Lather	273
	Plasterer	273
842.887	Plasterer helper	256
843.884	Waterproofer	277
844.884	Cement gun nozzleman	254
	Cement mason and apprentice	254
	Concrete rubber	254
	Concrete-wall-grinder operator	254
844.887	Cement-gun-nozzleman helper	256
	Cement mason helper	256
	Concrete-vibrator-operator helper	256
	Grouter helper	256
845.781	Painter, aircraft	645
	Painter, automobile	51
850.782	Horizontal-earth-boring-machine operator	269
	Shield runner	269
850.833	Bulldozer operator	269
	Dredge leverman	269

D.O.T. No.		Page
	Dredge operator	269
	Lock tender	269
	Mucking machine operator	269
	Power-shovel operator	269
	Rock-drill operator	269
	Scraper operator	269
	Tower-excavator operator	269
	Trench-digging machine operator	269
850.884	Bell man	269
	Dredge-dipper tender	269
	Sewer-bottom man	269
	Stripping-shovel oiler	269
850.887	Laborer, pile driving, ground work	256
	Laborer, road	256
	Laborer, shore dredging	256
	Miner helper II	256
	Mucker, cofferdam	256
	Sheeting puller	256
	Sheet-pile-hammer-operator helper	256
851.883	Blade-grader operator	269
	Elevating-grader operator	269
	Motor-grader operator	269
	Subgrader operator	269
	Utility-tractor operator	269
851.887	Ditch digger	256
	Dump grader	256
	Form-stripper helper	256
	Form tamper I	256
	Grader I	256
	Grade tamper	256
	Pipe-layer helper	256
852.883	Concrete-paver operator	269
	Concrete-paving-machine operator	269
	Form-grader operator	269
852.884	Cement mason, highways and streets	254
	Form setter, metal/road forms	254
852.887	Joint filler	256
	Laborer, concrete paving	256
	Mud-jack nozzleman	256
853.782	Asphalt-planer operator	269
	Asphalt-plant operator	269
853.883	Asphalt-paving-machine operator	269
	Stone-spreader operator	269
853.887	Cold-patch man	256
	Laborer, bituminous paving	256
	Squeegee man	256
859.782	Driller, water well	269
	Earth-boring-machine operator	269
	Foundation drill operator	269
	Pile-driver operator	269
	Well-driller operator, cable tool	269
	Well-drill operator, rotary drill	269
	Well-reactivator operator	269
859.883	Ballast-cleaning-machine operator	313
	Dragline operator	269, 631
	Operating engineer	269
	Operating engineer apprentice	269
	Road-mixer operator	269
	Road-roller operator	269
	Sweeper operator	269
	Tamping-machine operator	269, 313
859.887	Air-hammer operator	256
	Curb-setter helper	256
	Laborer, stone-block ramming	256
	Mucker	256
	Paving rammer	256
	Puddler, pile driving	256
	Well-digger helper	256
860.281	Carpenter inspector	252
	Carpenter, maintenance	252
	Ship's carpenter	302
860.381	Carpenter and carpenter apprentice	252
	Form builder	252
	Shipwright	252
	Tank builder and erector	252
860.781	Billboard erector-and-repairman	252
	Carpenter, rough	252
860.887	Carpenter helper, maintenance	256
	Laborer, carpentry	256
	Laborer, carpentry, dock	256
	Laborer, shaft sinking	256
	Shipwright helper	256
861.381	Bricklayer and apprentice	250
	Bricklayer, firebrick	250
	Marble setter	266
861.781	Stonemason and apprentice	280
	Terrazzo worker and apprentice	266
	Tilesetter and tilesetter apprentice	250
861.884	Tuck pointer	250
861.887	Brick cleaner	256
	Bricklayer helper	256
	Bricklayer helper, refractory brick	256
	Stonemason helper	256
862.281	Oil burner mechanic	411
862.381	Furnace installer	275, 411
	Gas-main fitter	275
	Pipe fitter I	275
	Pipe-fitter apprentice	275
	Pipe-fitter apprentice, sprinkler system	275
	Pipe-fitter, welding	275
	Plumber	275
	Plumber apprentice	275
862.887	Back-up man	256
	Clampman	256
	Connection man	256
	Crankman	256
	Laborer, pipe line	256
	Laborer, plumbing	256
863.381	Pipe coverer and insulator	248
863.781	Cork insulator, interior surface	248
863.884	Composition-weatherboard applier	248
	Insulation hoseman	248
	Insulation installer	248
	Insulation worker	248
	Insulation worker apprentice	248
864.781	Floor layer	261
865.781	Glazier	264
865.887	Glazier helper	256

D.O.T. No.		Page
866.381	Roofer	277
866.887	Roofer helper	256
869.281	Furnace installer	411
869.883	Rigger and machine mover	282
869.884	Brattice man	631
	Rig builder	635
	Roustabout	636
869.887	Concrete-pump-operator helper	256
	Construction worker II	256
	Form-setter helper	256
	Form stripper	256
	Hod carrier	256
	Laborer, cement-gun placing	256
	Laborer, wrecking and salvaging	256
	Loftsman, pile-driving	256
	Mixer, hand, cement gun	256
	Reinforcing-iron-worker helper	256
	Rig-builder helper	635
	Track worker	313
	Trashman	256
891.138	Maintenance foreman	155
900.883	Concrete-mixing-truck driver	319
902.883	Dump-truck driver	319
903.883	Tank-truck driver	319, 321
904.883	Tractor-trailer-truck driver	321, 758
905.883	Truck driver, heavy	321
905.887	Truck-driver helper	759
906.883	Truck driver	319, 758
909.883	Garbage collector I	321
	Hostler	321
	Van driver	319
909.887	Material handler	759
910.138	Station agent	312
910.364	Brakeman	305
910.368	Railway express clerk	97
	Reservation clerk	97
910.383	Fireman, locomotive	309
	Locomotive engineer	308
910.388	Yard clerk	101
910.782	Towerman	313
	Track repairman	313
910.884	Brakeman	305
911.131	Boatswain	27, 302, 743
911.368	Clerk and dispatcher, pilot station	745
911.388	Receipt-and-report clerk	745
911.883	Longshoreman	744
911.884	Able seaman	301
	Deck utilityman	301
	Marine oiler	302, 744
911.887	Ordinary seaman	301, 743
912.168	Airline dispatcher	289
912.368	Airplane-dispatch clerk	297
	Transportation agent	297
913.363	Bus driver	315, 317
	Taxi driver	325
913.368	Assignment clerk	100
913.463	Bus driver	315, 317
914.132	Compressor-station engineer	636
914.381	Gager	636
914.782	Pumper	636
915.867	Automobile-service-station attendant	224
915.878	Parking-lot attendant	324
915.887	Lubrication man	759
919.168	Dispatcher	759
919.368	Ticket agent	297
919.883	Motorman	693
919.887	Cleaner	313, 759
	Track worker	313
920.887	Bagger	785
	Blueprint trimmer	90, 97
	Marker II	97
	Packager, hand	97
921.280	Rigger II	759
921.281	Crane operator	759
	Hoisting engineer	701
921.883	Hot-metal crane operator	650
	Ingot stripper	694
	Ladle craneman	694
	Skip operator	693
	Soaking pit craneman	695
921.885	Bull-chain operator	701
921.886	Pondman	701
922.782	Stacker-hoist-and-sorter pocket man	73
922.883	Electric-freight-car operator	73
	Electric-truck-crane operator	73
	Industrial-truck operator	73
	Power truck operator	759
	Straddle-truck operator	73
922.887	Sorter	702
929.883	Tractor operator	631
929.887	Material handler	656
930.130	Tool pusher	636
930.281	Cementer	637
930.782	Acidizer	637
	Augerman	631
	Derrickman	635
	Drilling-machine operator	631
	Rotary driller	635
	Shot-hole driller	635
930.883	Continuous-mining-machine operator	631
	Cutter operator	631
	Roof bolter	631
	Well puller	637
930.884	Rotary-driller helper	635
930.886	Shot-hole driller	635
931.381	Shooter	635
931.781	Sample-taker operator	637
931.782	Perforator operator	637
932.883	Loading machine operator	631
	Shuttle car operator	631
934.885	Shaker tender	632
939.138	Section foreman	631
939.387	Fire boss	631
939.887	Rock-dust man	631
940.884	Bucker	701
	Faller	701
941.488	Log scaler	701
942.782	Donkey engineer	701

D.O.T. No.		Page
942.884	Rigging slinger	701
942.887	Chokerman	701
949.884	Second loader	701
950.131	Watch engineer	737
950.168	Load dispatcher	739
950.782	Boiler operator	736
	Engineman	635
	Gas-compressor operator	636
	Gasoline-plant operator	636
	Refrigeration engineer	302
	Stationary engineer	75
951.885	Fireman, high pressure	77
	Fireman, low pressure	77
	Fireman/watertender	302, 744
952.138	Turbine operator	736
952.782	Auxiliary equipment operator	737
	Substation operator	739
	Switchboard operator	737
953.168	Gas dispatcher	100
955.782	Sewage-plant operator	79
957.282	Audio operator	387
	Control-room-technician	387
	Master-control engineer	387
	Transmitter operator	387
	Video operator	387
960.382	Motion-picture projectionist	69
961.868	Model, artists'	228
	Model, photographers'	228
963.	Occupations in radio and television production, n.e.c.	387
969.387	Custodian, athletic equipment	101
970.281	Airbrush artist	589
	Delineator	589
	Form designer	589
	Painter, plate	589
	Photograph retoucher	71
970.381	Ben-day artist	589
	Colorist, photography	589
	Engrosser	589
	Lay-out man	589
	Letterer	589
	Music grapher	589
	Painter, sign	589
	Repeat chief	589
	Retoucher, photoengraving	589
	Sketch maker, photoengraving	589
971.281	Etcher, hand	46, 726
971.381	Photoengraver	45, 726
971.382	Photographer, photoengraver	46
972.281	Lithographic artist	45
972.381	Plate maker	726
972.382	Cameraman	45, 726
972.781	Platemaker	45
973.381	Hand compositor (typesetter)	41, 726
974.381	Electrotyper	43, 726
	Electrotyper, apprentice	43, 726
975.782	Stereotyper	43, 726
	Stereotyper, apprentice	43, 726
976.381	All-round darkroom technician	70
	Color technician	71
	Developer	71
	Printer	71
976.687	Photo checker and assembler	71
976.782	Printer operator	71
976.884	Chemical mixer	71
976.885	Print developer, machine	71
	Slide mounter	71
976.886	Photograph finisher	70
976.887	Film numberer	71
	Stripper	71
977.781	Bookbinder	40
979.381	Letterer	589
	Line-up man	589
	Paste-up man	589
	Paste-up man, apprentice	589
	Silk-screen cutter	589
	Silk-screen maker	589
	Stencil maker	589

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	SERVICE OCCUPATIONS	
28	Building Custodians	25
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31	Meat Cutters	25
32	Barbers, Cosmetologists	25
33	Funeral Directors and Embalmers	25
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36	Firefighters	25
37	Guards and Watchmen	25
38	Police Officers, State Police Officers	25
39	Health and Regulatory Inspectors, Construction Inspectors	30
	EDUCATION AND RELATED OCCUPATIONS	
40	Teaching Occupations	25
	Kindergarten and Elementary School Teachers	
	Secondary School Teachers	
	College and University Teachers	
41	Library Occupations	25
	Librarians	
	Library Technical Assistants	
	SALES OCCUPATIONS	
42	Automobile Salesworkers	25
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	CONSTRUCTION OCCUPATIONS	
49	Asbestos and Insulating Workers	25
50	Bricklayers, Stonemasons, Marble Setters, Tile Setters, and Terrazzo Workers	25
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	OCCUPATIONS IN TRANSPORTATION ACTIVITIES	
60	Driving Occupations	30
	Intercity Bus Drivers	
	Local Transit Bus Drivers	
	Local Truck Drivers	
	Long Distance Truck Drivers	
	Routemen	
	Taxi Drivers	
61	Parking Attendants	25
	SCIENTIFIC AND TECHNICAL OCCUPATIONS	
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	Foresters	
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	Range Managers	
	Soil Conservationists	

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	Mining	
64	Environmental Scientists	30
	Geologists	
	Geophysicists	
	Meteorologists	
	Oceanographers	
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	Biochemists	
	Life Scientists	
	Soil Scientists	
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	Mathematicians	
	Statisticians	
67	Physical Scientists	30
	Astronomers	
	Chemists	
	Food Scientists	
	Physicists	
68	Technician Occupations	30
	Draftsmen	
	Engineering and Science Technicians	
	Food Processing Technicians	
	Surveyors	
69	Automobile Service Occupations	35
	Automobile Body Repairmen, Automobile Mechanics, Truck and Bus Mechanics, Automobile Trimmers and Installation Men (Automobile Upholsterers), Automobile Parts Countermen, Automobile Service Advisors, Gasoline Service Station Attendants, Automobile Painters	
70	Air-conditioning, Refrigeration and Heating Mechanics	25
71	Appliance Servicemen	25
72	Boat Motor Mechanics, Motorcycle Mechanics	25
73	Bowling Pin Machine Mechanics	25
74	Business Machine Servicemen, Computer Service Technicians	25
75	Diesel Mechanics	25
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79	Maintenance Electricians, Industrial Machining Repairmen, Millwrights	25
80	Instrument Repairmen	25
81	Jewelers, Watch Repairmen	25
82	Locksmiths	25
83	Piano and Organ Servicemen	25
84	Shoe Repairmen	25
85	Television and Radio Service Technicians	25
86	Vending Machine Mechanics	25
	HEALTH OCCUPATIONS	
87	Chiropractors	25
88	Optometrists, Optometric Assistants	25
89	Dental Occupations	25
	Dentists, Dental Assistants, Dental Hygienists, Dental Laboratory Technicians	25
90	Physicians, Osteopathic Physicians	25
91	Podiatrists	25
92	Veterinarians	25
93	Medical Technicians, Technologists, and Assistant Occupations	30
	Electrocardiograph Technicians	
	Electroencephalograph Technicians	
	Medical Assistants	
	Medical Laboratory Workers	
	Operating Room Technicians	
	Radiologic (X-ray) Technicians	
	Respiratory Technicians	
94	Nursing Occupations	25
	Registered Nurses	
	Licensed Practical Nurses	
	Nursing Aides, Orderlies, and Attendants	
95	Therapy and Rehabilitation Occupations	25
	Occupational Therapists	
	Occupational Therapy Assistants	
	Physical Therapists	
	Physical Therapy Assistants and Aides	
	Speech Pathologists and Audiologists	
96	Dietitians	25
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	SOCIAL SCIENTISTS	
101	Anthropologists, Economists, Geographers, Historians, Political Scientists, Sociologists	30
	SOCIAL SERVICE OCCUPATIONS	
102	Counseling Occupations	25
	School Counselors	
	Employment Counselors	
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105	Psychologists	25
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108	Performing Arts Actors and Actresses Dancers Musicians Singers	30
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110	Commercial Artists	25
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112	Floral Designers	25
113	Industrial Designers	25
114	Interior Designers	25
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	SOME MAJOR INDUSTRIES AND THEIR OCCUPATIONS	
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